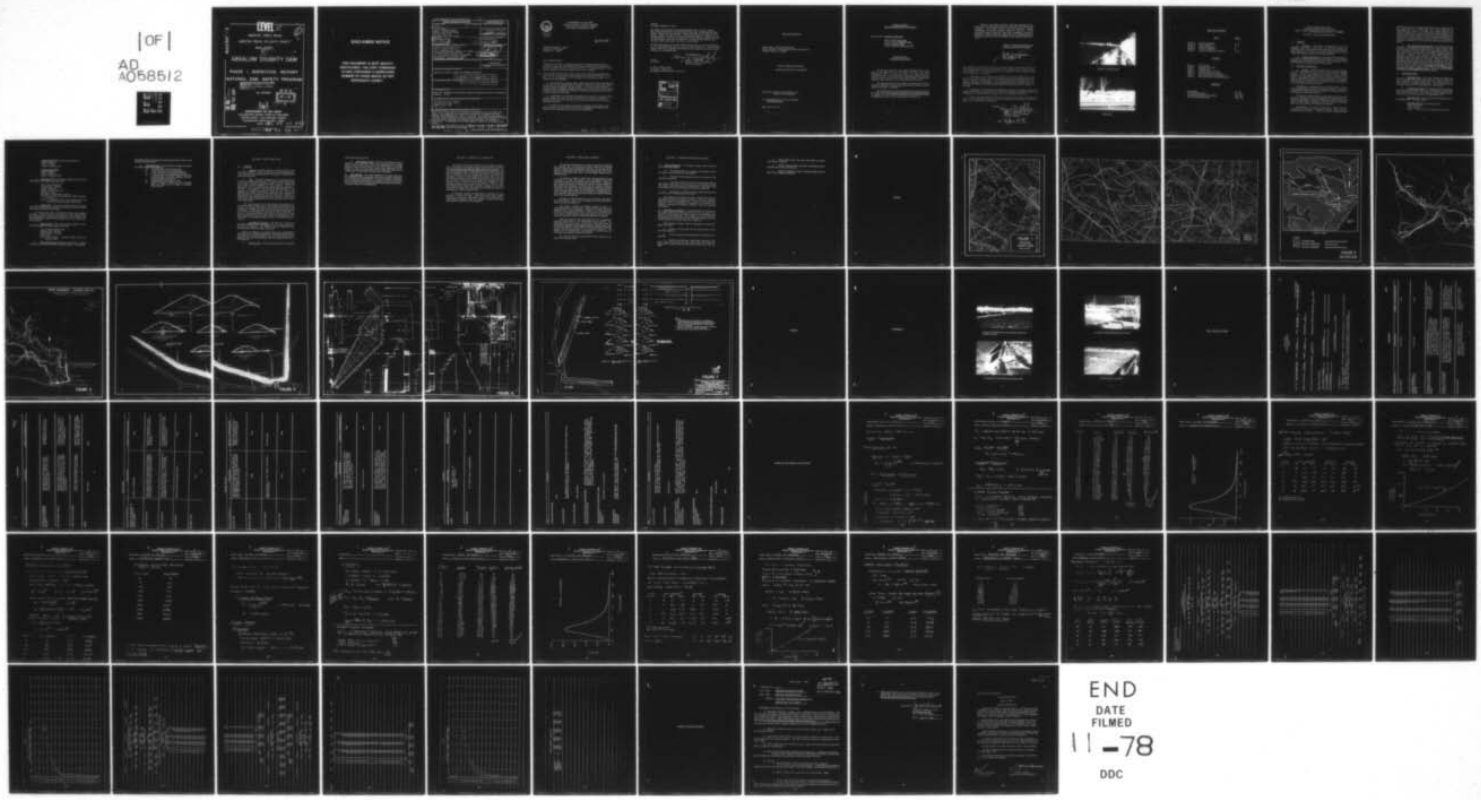
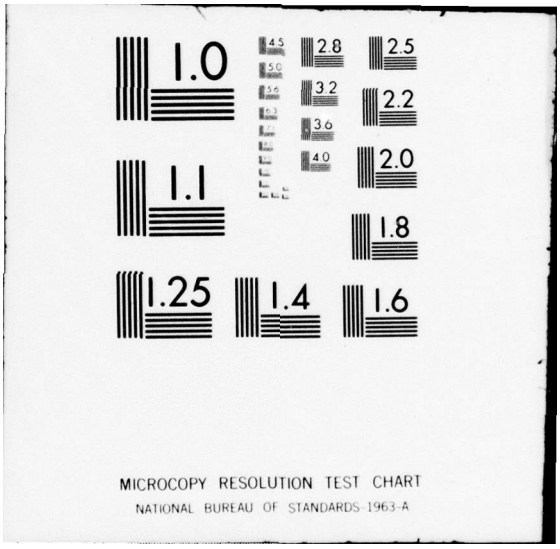
AD-A058 512 O'BRIEN AND GERE ENGINEERS INC PHILADELPHIA PA JUSTIN--ETC F/G 13/2
NATIONAL DAM SAFETY PROGRAM. ABSALOM DOUGHTY DAM (NJ00080), ABS--ETC(U)
APR 78 J J WILLIAMS DACW61-78-C-0052

UNCLASSIFIED NL

| OF |
AD
A058512



END
DATE
FILMED
11-78
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

ABSECON CREEK BASIN

ABSECON CREEK, ATLANTIC COUNTY

NEW JERSEY

ABSALOM DOUGHTY DAM

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00080

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

APRIL 1978

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00080	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: Phase I Inspection Report National Dam Safety Program Absalom Doughty Dam Antlantic County, New Jersey	5. TYPE OF REPORT & PERIOD COVERED: 9 FINAL rept.
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): John J. Williams P.E.	8. CONTRACT OR GRANT NUMBER(s): DACW61-78-C-0052
9. PERFORMING ORGANIZATION NAME AND ADDRESS: O'Brien & Gere Engineers Inc. Justin & Courtney Division 1617 J.F.Kennedy Blvd., Phila., PA 19103	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 12 78p
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106	12. REPORT DATE: 17 APR 1978
	13. NUMBER OF PAGES: 70
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*: Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

National Dam Safety Program. Absalom Doughty Dam (NJØØØ8Ø), Absecon Creek Basin, Absecon Creek, Atlantic County, New Jersey, Phase 1 Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

National Dam Safety Program
Dam Inspection Report Phase I
Absalom Doughty Dam
Dams - N.J.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

78 07 14 030

410 760

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-D

16 JUN 1978

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Absalom Doughty Dam in Atlantic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given on pages 1 and 2 of the report.

The inspection indicates the dam to be in poor condition primarily because of the concrete slab, slope protection on the upstream face of the dam. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Restoration of concrete slab, slope protection on the upstream face of the dam, if not already begun, should be initiated within three months after the date of approval of this report. If for any reason this restoration work is delayed, temporary protection, such as sand bagging and/or flexible liner installation, should be undertaken immediately to preclude possible failure of the dam.

b. A hydraulic and hydrologic investigation should be initiated within six months after the date of approval of this report to determine spillway modifications necessary to accommodate the spillway flood with adequate freeboard.

c. Within one year after the date of approval of this report, the trees and brush on the embankment should be removed and replaced with ground covers normally used on earth dam embankments.

NAPEN-D
Honorable Brendan T. Byrne

Two copies of the report are being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Edwin B. Forsythe of the Second District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, thirty days after the date of this letter.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

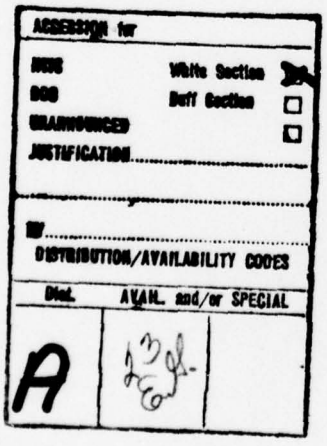
Sincerely yours,

Harry V. Dutchyshyn

1 Incl
As stated

HARRY V. DUTCHYSHYN
Colonel, Corps of Engineers
District Engineer

Cy Furn: w/incl (dupe)
Mr. Dirk C. Hofman, P.E.
Deparment of Envirnmental Protection



ABSECON BAY BASIN

Name of Dam: Absalom Doughty Dam
County and State: Atlantic County, State of New Jersey
Inventory Number: NJ 00080

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Prepared by: O'Brien & Gere Engineers, Inc.
Justin & Courtney Division

For: United States Army Corps of Engineers
Philadelphia District

Date: April 17, 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Absalom Doughty Dam

State Located New Jersey
County Located Atlantic County
Stream Absecon Creek
Date of Inspection March 17, 1978

ASSESSMENT OF GENERAL CONDITIONS

The physical condition of the Absalom Doughty Dam, at the time of the inspection, was very poor. The dam is an earth embankment with a concrete core wall and a steel sheet pile foundation cutoff. It is protected on the upstream slope and crest by concrete slabs, several of which have been displaced. Considerable erosion and some settlement of the embankment has occurred.

The Spillway Design Flood (SDF) of one-half the Probable Maximum Flood (PMF) overtops the embankment by 0.8foot, and the spillway, therefore, is inadequate.

On the basis of the visual examination of the area downstream of the dam and the Recommended Guidelines of the Safety Inspection of Dams, this dam should be placed in the Significant Hazard Classification, rather than the High Hazard Classification.

Plans for the repair of the dam have been developed by the owner, but this repair work was not completed at the time of the inspection. The eroded areas of the dam should be repaired immediately to prevent complete failure of the dam. If the permanent repairs cannot be completed immediately, temporary protective measures should be taken, such as the installation of a flexible liner, or placement of sandbags, on the upstream slope of the dam.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

John J. Williams

John J. Williams, P.E.
Vice President

The inspection indicates the dam to be in poor condition primarily because of considerable erosion and some settlement of the upstream face, concrete slab, slope protection. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Restoration of concrete slope protection of the upstream face of the dam, if not already begun, should be initiated within three months after the date of approval of this report. If for any reason this restoration work is delayed, temporary protection, such as sandbagging and/or flexible liner installation, should be undertaken immediately to preclude possible failure of the dam.

b. A hydraulic and hydrologic investigation should be initiated within six months after date of approval of this report to determine spillway modifications necessary to accommodate the spillway flood with adequate freeboard.

c. Within one year after the date of approval of this report the trees and brush on the embankment should be removed and replaced with ground covers normally used on earth dam embankments.

APPROVED: Harry V Dutchyshyn

HARRY V. DUTCHYSHYN
Colonel, Corps of Engineers
District Engineer

DATE: 16 June 1978

OVERALL VIEW OF DAM

SPILLWAY

TABLE OF CONTENTS

FIGURES

APPENDIX

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM ABSALOM DOUGHTY DAM ID# NJ00080

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract #DACW 61-78-C-0052 between O'Brien & Gere Engineers, Inc., Justin & Courtney Division, and the United States Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic condition of the Absalom Doughty Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 PROJECT DESCRIPTION

a. General - Absalom Doughty Dam is an earth embankment dam with a concrete core wall and a steel sheet pile seepage barrier. The dam and spillway were raised in 1914. Records pertaining to the original construction were not available for our review. The upstream slope and crest is lined with concrete slabs about 6 inches thick, supported at the top and bottom of the slope by concrete beams. Portions of the downstream slope of the embankment are covered with trees and brush.

The spillway is an ungated concrete overflow section. Reservoir drain pipes are located at each end of the spillway. A concrete stilling basin is constructed below the spillway. Spillway discharge is monitored by a water-stage recorder.

The dam is located on Absecon Creek about one mile west of the City of Absecon, and 3.4 miles upstream from Absecon Bay. It is owned and operated by the City of Atlantic City, New Jersey and is used for water supply. Operation of the dam consists of pumping water from the reservoir, as needed for distribution.

Maintenance of the dam has been poor. Several areas of settlement and collapse of protective concrete slabs along the upstream face are visible. A chain link fence is being installed

around the reservoir. In August, 1975, Atlantic City contracted with the engineering firm of Remington and Boyd, Engineers, of Pennsauken, New Jersey, for a study on necessary repairs to the Absalom Doughty Dam. A permit application was subsequantly filed with the New Jersey Department of Environmental Protection by Atlantic City in May, 1977, to cover the recommended repair work. The extent of proposed repairs is noted on Figure 7. At the date of inspection, the repair work noted in the May, 1977 application had not begun.

b. Size and Hazard Classification - The maximum storage capacity of the reservoir (to the crest of the dam) is about 2,100 acre-feet and the maximum height of the dam is about 18 feet. The dam is located at the upper limit of the Absecon Creek tidal marsh. This marsh is very wide and flat, and is sparsely populated along its perimeter. Failure of the structure would affect bridges and adjoining roads across Absecon Creek, and might cause flooding of buildings along the fringe of the marsh. Based on the visual examination, the potential for loss of human life appears to be small. Because of the low potential for loss of life in the event of a failure, the dam should be placed in the significant hazard category, rather than the high hazard category, as defined by the Recommended Guidelines for Safety Inspection of Dams. Therefore, the design flood is one-half of the Probable Maximum Flood (PMF).

1.3 PERTINENT DATA

a. Drainage Areas - The total drainage area above the Absalom Doughty Dam is 16.7 square miles. 8.7 square miles of the area is upstream of Doughty Pond Upper Dam, which is about 1.5 miles upstream of Absalom Doughty Dam. The remaining 8 square miles drains directly to the lower reservoir. (See Figure 2).

b Discharge at Damsite The calculated spillway capacity with the reservoir at the crest of the embankment is about 3,700 cubic feet per second (cfs). The maximum average daily discharge, according to the records, was 295 cfs on September 6, 1935.

c. Reservoir Data - (from United States Geological Survey Quadrangle Sheet - 7.5 minute Series).

Normal Pool (Reservoir at spillway crest)
Length - 6,500 feet
Area - 225 acres
Volume - 750 acre-feet (from gaging station record)

Top of Dam (Reservoir at top of embankment)
Length - 9,000 feet
Area - 335 acres
Volume - 2,100 acre-feet

Maximum Pool (½PMF)
Length - 9,500 feet
Area - 350 acres
Volume - 2,400 acre-feet

d. Dam Data (from the drawings supplied by New Jersey Department of Environmental Protection)

Type - earth embankment
Top elevation - 17.0 feet
Length - 2,850 feet
Height - 18 feet (maximum)
Top width - 8 feet
Side slopes - 2 horizontal : 1 vertical
Concrete core where the embankment height is greater than 9 feet
Cutoff - Interlocking steel sheet piling where the embankment height is greater than 10 feet

e. Outlet Data - A concrete intake structure is located about 300 feet south of the spillway. Drawings show a 42 inch wood outlet pipe connected to the structure.

A 30 inch drain pipe is constructed through each spillway abutment. Although the valve assemblies were not in place during the inspection, Mr. McLees, Superintendent of the Atlantic City Water Department, stated that the assemblies are now in place and are operational.

f. Spillway Data - (from the drawings supplied by New Jersey Department of Environmental Protection)

Type - concrete overflow weir
Length of weir - 110 feet
Crest elevation - 12.0 feet
Gates - none
Downstream channel - concrete stilling basin and Absecon Creek

g. Flood Elevations at the Dam (Local Datum) - Flood conditions for one-half of the PMF were investigated. The Doughty

Pond Upper Dam is overtopped by 0.8 feet, assuming no failure of the Doughty Pond Upper Dam.

h. Engineering Data - The information available for review of Absalom Doughty Dam included:

1) A location Plan of the dam (Figure 4)
2) A Plan and Sections of the dam (Figure 5)
3) A Plan and Section of the spillway (Figure 6)
4) A Plan Sections of proposed repairs to the dam by Remmington and Boyd, Engineers of Pennsauken New Jersey (Figure 7)
5) Correspondence concerning the dam
6) Previous inspection reports by John N. Brooks (April 22, 1942) and by Joseph A. Dehnick (May 15, 1968)

SECTION 2 - VISUAL INSPECTION

2.1 FINDINGS

a. General - The field inspection of Absalom Doughty Dam took place on March 17, 1978. At the time of the inspection, about 3 to 4 inches of water was flowing over the spillway. No underwater areas were inspected.

b. Dam - The earth embankment is constructed primarily of sand, with some gravel and clay. The upstream face and the crest of the dam are covered with concrete slabs. Several of these slabs have either settled, collapsed, or been displaced. Erosion or settlement of up to 3 feet has occurred along the upstream face of the dam. The collapse of one slab about 600 feet south of the spillway has allowed wave action to erode the top 3 feet of the embankment to within 2 feet of the downstream face. Openings of about 18 inches by 8 inches were observed at the joints. Voids in the embankment were observed through these openings. Sand fill has recently been placed downstream of the toe of the dam in the vicinity of the pump station.

The central portion of the embankment has recently been cleared of brush and small trees. Heavy underbrush and trees up to 12 inches in diameter were noted on the slopes at both ends of the embankment. A 400-foot portion of the downstream slope of the dam on the north side terminates at a concrete wall about 4 feet high. A swale in the downstream slope, about 40 feet wide and up to 2.5 feet deep, was observed above the wall. South of the embankment, a 50-foot section of the adjacent ground is about 3 feet below the top of the dam.

c. Appurtenant Structures - The spillway is a concrete ungated overflow structure that appeared to be in good condition at the time of inspection. The adjoining concrete abutments have noticeable age cracks, but appear to be sound.

Below the spillway is a stilling basin and a United States Geological Survey Stream Gaging Station. Platforms are attached to each abutment for access to operate the reservoir drain pipes, but the operating assemblies for these pipes were not in place at the time of the inspection.

d. Reservoir Area - The reservoir perimeter is uninhabited

and the slopes are very mild.

e. Downstream Channel - Absecon Creek below the dam is subject to tidal variations. The stream discharges under a bridge located about 50 feet downstream of the stilling basin. The bridge opening is about 50 feet wide and 5 feet high. Downstream of the bridge is a wide, flat tidal marsh 2,000 to 4,000 feet wide which is virtually free of improvements except roads and bridges.

2.2 EVALUATION - The visual inspection of the site shows that the embankment and appurtenent structures are poorly maintained. The concrete slab slope protection is in need of repair, as evidenced by the embankment settlement and collapse of several of the slabs. Erosion at these areas is severe, and continued erosion could result in a complete failure of the embankment.

SECTION 3 - HYDROLOGY & HYDRAULICS

The Spillway Design Flood (SDF) used for Absalom Doughty Dam is one-half of the Probable Maximum Flood (PMF) according to the Recommended Guidelines for Safety Inspection of Dams. The SDF was calculated from the Probable Maximum Precipitation using standard reduction factors. PMF runoff increments were divided by two and applied to the Soil Conservation Service curvilinear unit hydrograph. Runoff into the Doughty Pond Upper Dam was routed through this reservoir before being combined with runoff into the lower reservoir. Routing of the combined inflow through the lower reservoir did not reduce the peak discharge of 11,000 cfs. This discharge would overtop the dam by about 0.8 feet. During $\frac{1}{2}$ PMF, the Doughty Pond Upper Dam would be overtopped by 1.8 feet. Failure of the Upper Dam would obviously increase the amount of overtopping of Absolom Doughty Dam.

A drawdown analysis was performed to evaluate the time necessary to lower the pool. With the starting water surface elevation at the spillway crest and no inflow, it is estimated that 6 days would be required to drain the reservoir. (See the Hydrologic and Hydraulic Calculations in the appendix).

SECTION 4 - STRUCTURAL STABILITY

The Absalom Doughty Dam is located on the gently undulating, but relatively flat and featureless eastern edge of the exposed Atlantic Coastal Plain physiographic province. To the east lie the shallow swamps, bays and lagoons which separate this "fast land" portion of the coastal plain from the barrier beach strands and the Atlantic Ocean.

As shown on Figure 3, both dams are physically set and constructed in sands and gravels of the Quaternary Cape May formation, as shown on the Geologic Map of New Jersey. Underlying this surficial unit, and in unconformable contact are the remnants of the Quaternary Bridgeton formation and the Tertiary Cohansey formation, the latter being the predominant substructure feature which dips very gently east and southeastward. All geologic units involved consist predominantly of cohesionless and erodible sediments with occasional clay units occurring as lenses of variable thickness and erratic areal distribution.

The dam is in Seismic Risk Zone 1 of the Seismic Zone Map of the United States. Due to the low height of the dam, the risk of seismic damage is probably low.

The present condition of Absalom Doughty is poor. A considerable amount of settlement or erosion has occurred along the upstream face of the embankment. Where the concrete slab slope protection has collapsed, the effects of the erosion or settlement are most severe. Strong westerly winds could generate waves of up to 3 feet that could wash away the cohesionless embankment material.

Where the concrete slab slope protection has not collapsed, additional undermining of the embankment may be hidden. The effectiveness of the concrete core and the steel sheet piles for embankment stabilization and seepage control is unknown, since they could not be observed. Some portions of the embankment are heavily covered with brush and trees up to 12 inches in diameter. The stability of the embankment is questionable in eroded areas, as evidenced by the physical condition of the dam.

The concrete spillway and abutment system appears to be stable and in good condition.

SECTION 5 - ASSESSMENT/REMEDIALMEASURES

5.1 DAM ASSESSMENT - The Absalom Doughty Dam is deficient in the following respects:

a. The embankment has undergone considerable erosion and some minor settlement near the spillway.

b. The concrete slab slope protection on the upstream face has been undermined.

c. The heavy growth of trees on the downstream slope is detrimental to the safety of the dam since the root systems increase the seepage potential through the embankment. High winds could uproot trees, thus removing large portions of the embankment.

d. The spillway is unable to pass the spillway design flood ($\frac{1}{2}$ PMF) without overtopping the embankment.

The condition of the dam is very poor. Failure of the concrete slab slope protection has already occurred in a number of locations, creating the potential for rapid failure. For these reasons, temporary measures, such as sandbagging or installation of a flexible liner, should be considered if permanent measures cannot be completed immediately.

5.2 REMEDIAL MEASURES - The Superintendent of the Atlantic City Water Department has stated that the repair work specified in the study by Remington and Boyd, Engineers, of Pennsauken, New Jersey, is nearing completion. The remedial work was not inspected in conjunction with this report, and the following measures are based on the condition of the dam at the time of inspection.

The following measures could be considered for permanent repair of the dam:

a. Remove concrete slabs on the upstream slope which have been displaced.

b. Fill the eroded areas under the slabs with suitable earth materials.

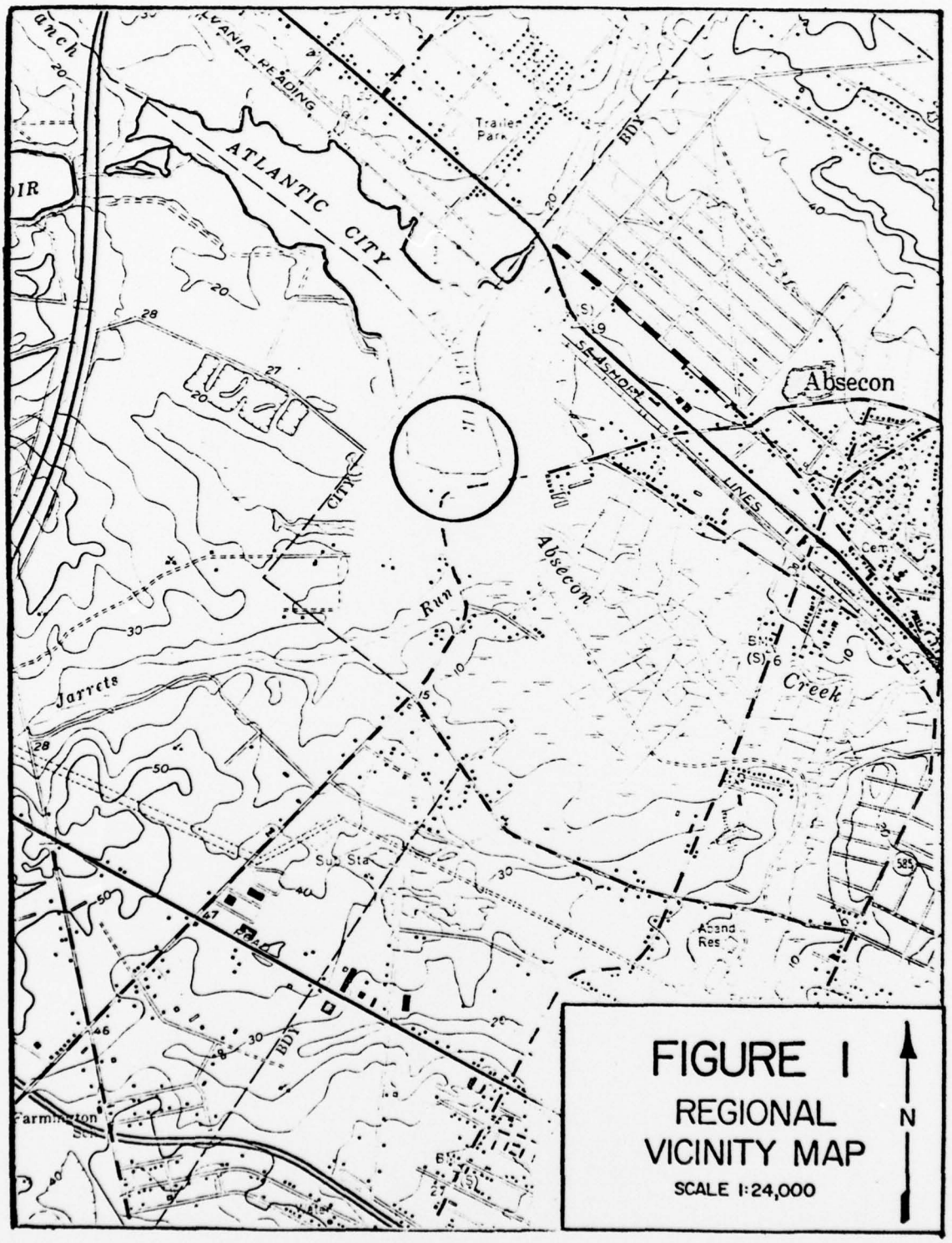
c. Replace concrete slabs. Graded filter material or filter fabric should be placed over the earth before the slabs are constructed. Expansive filler should be used in the joints of the new slabs.

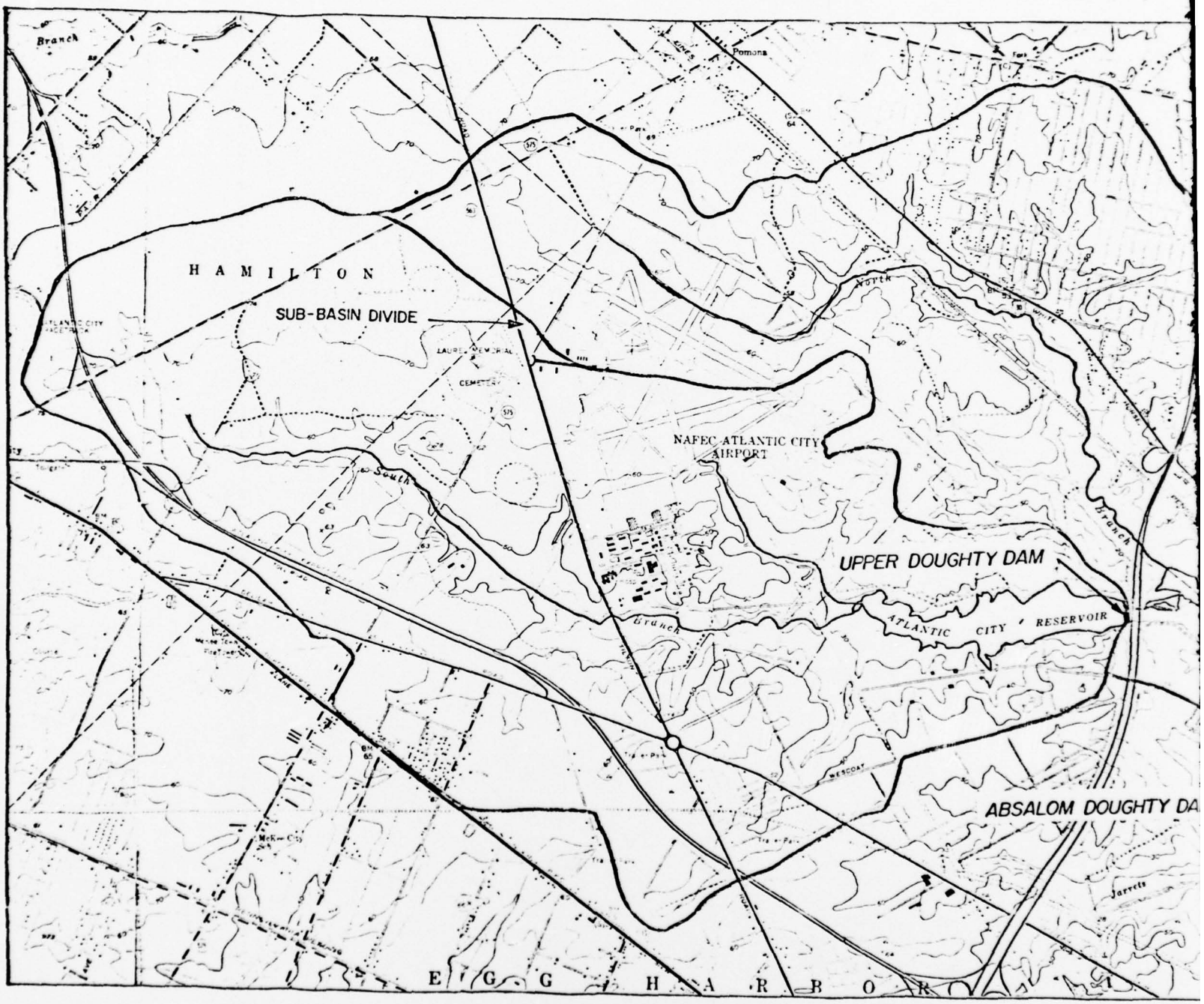
d. Pump cement grout into areas where slabs are undermined but not displaced.

e. Remove trees and brush and replace with ground covers normally used on dam embankments.

f. Modify the spillway to pass the spillway design flood ($\frac{1}{2}$ PMF) with an adequate freeboard.

FIGURES


ATLANTIC CITY
Absecon
Absecon Run
Jarrets Creek
Trailer Park
Sub Sta
Abnd Res
Farmington
Cem
LINES
FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000
N


HAMILTON
SUB-BASIN DIVIDE
NAFEC ATLANTIC CITY AIRPORT
UPPER DOUGHTY DAM
ATLANTIC CITY RESERVOIR
ABSALOM DOUGHTY DA
EGG HARBOR
Pomona
South
North
Branch

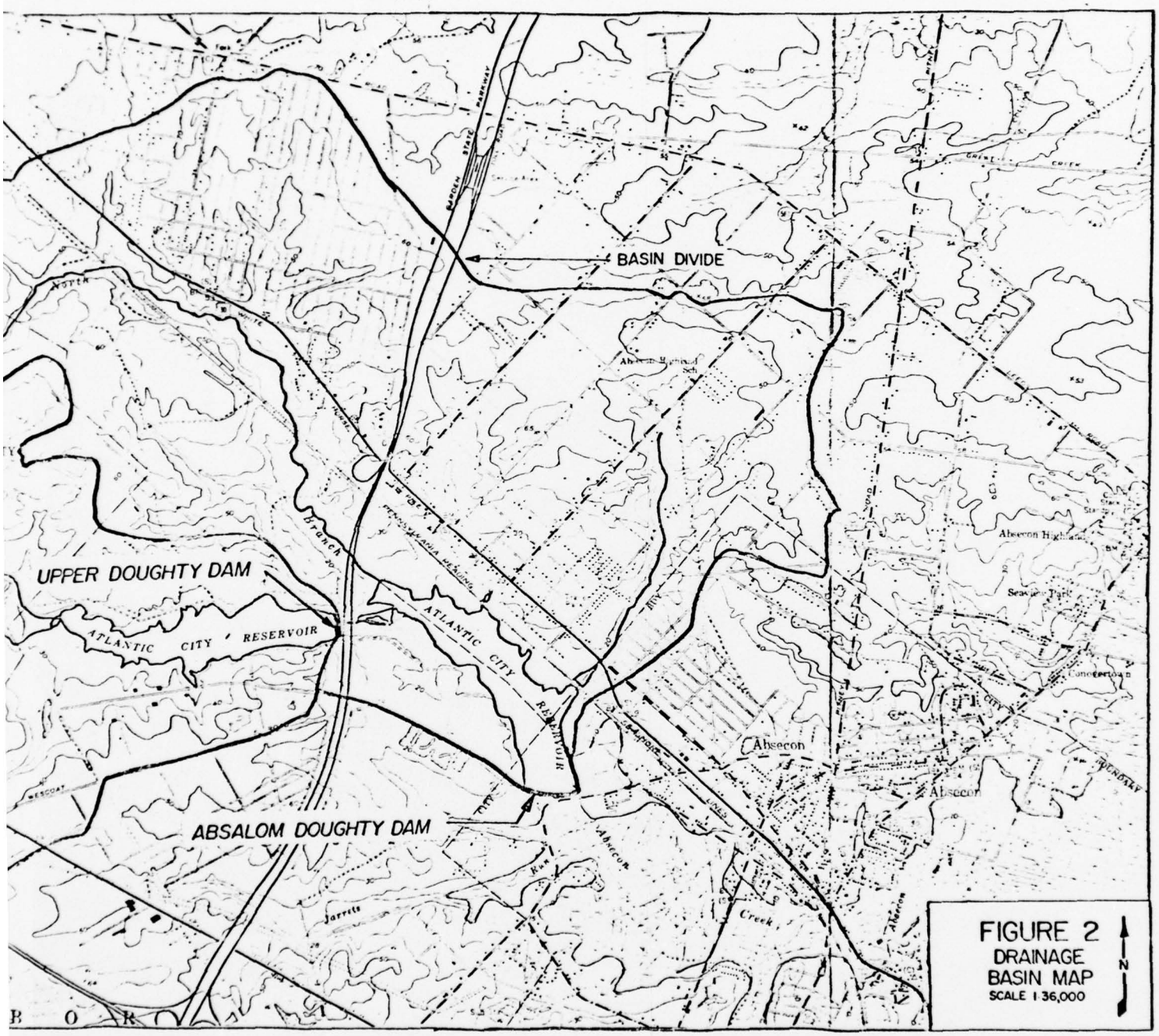
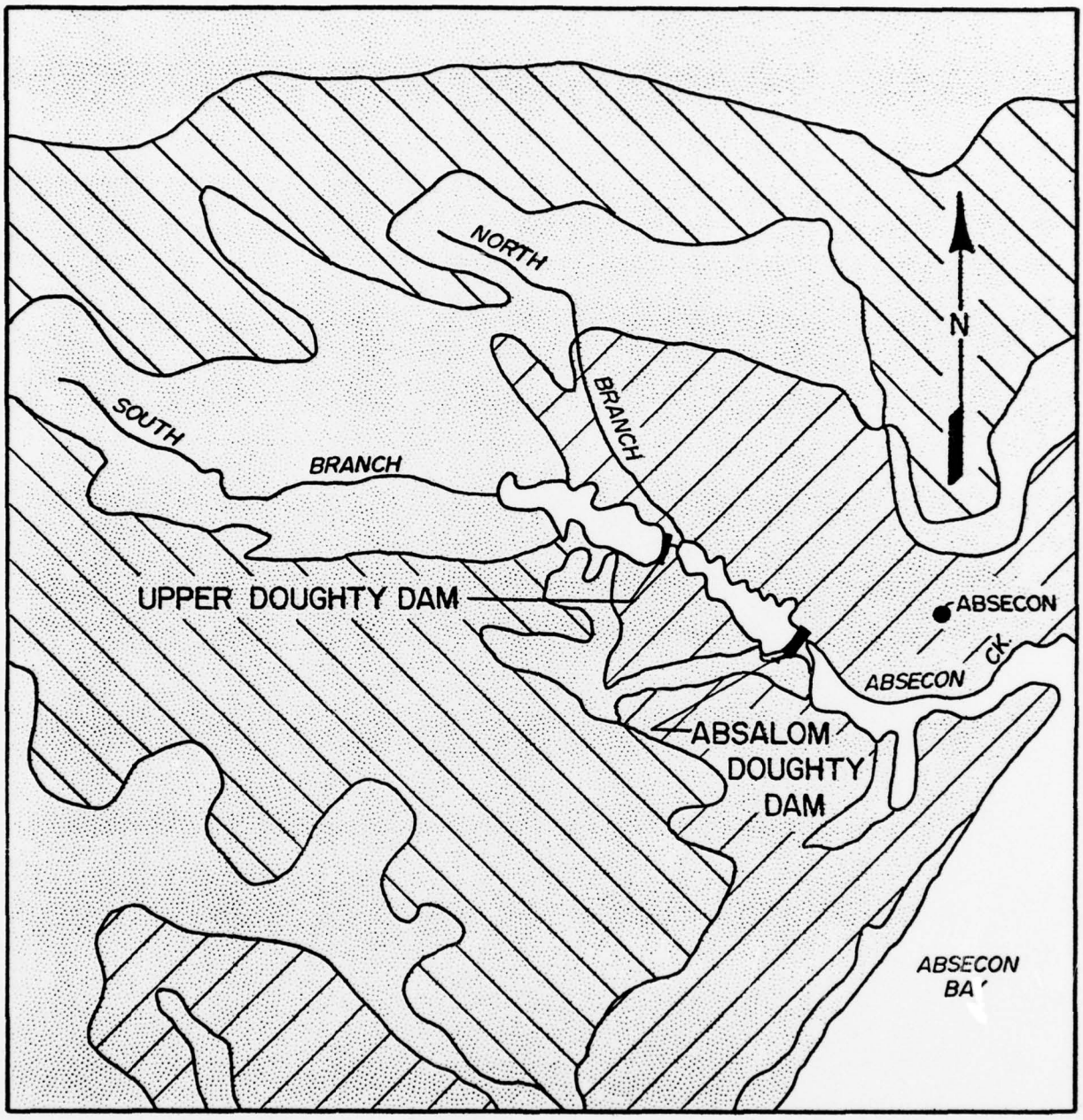


FIGURE 2
DRAINAGE BASIN MAP
SCALE 1:36,000

2



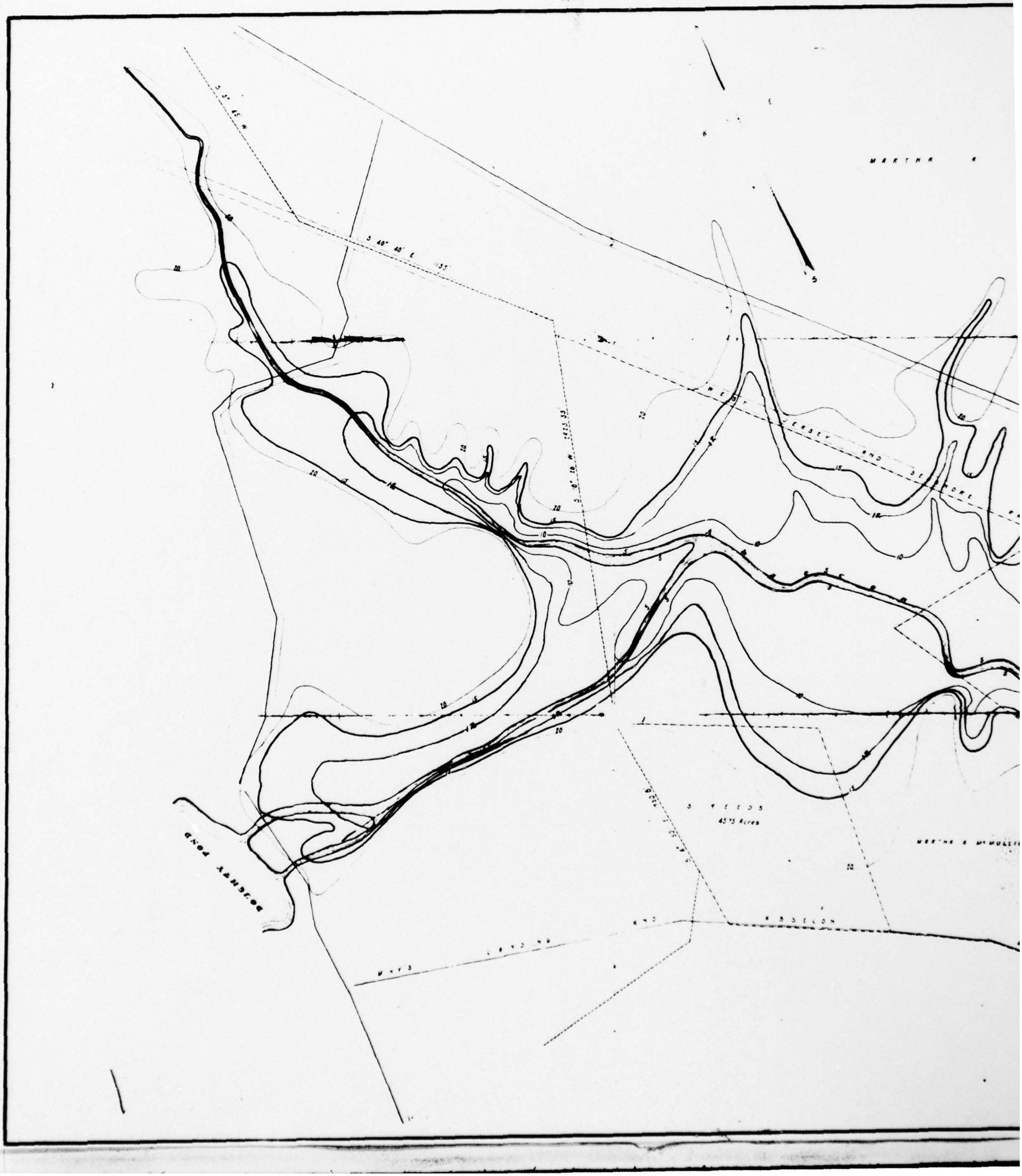
SCALE 1"= 1 MILE

LEGEND:

	COHANSEY SAND	Sand, with some clay and gravel.
	BRIDGETON FORMATION	Gravel and sand.
	CAPE MAY FORMATION	Gravel and sand with some clay.

FIGURE 3

GEOLOGIC MAP


MARTHA
DOUGHTY POND

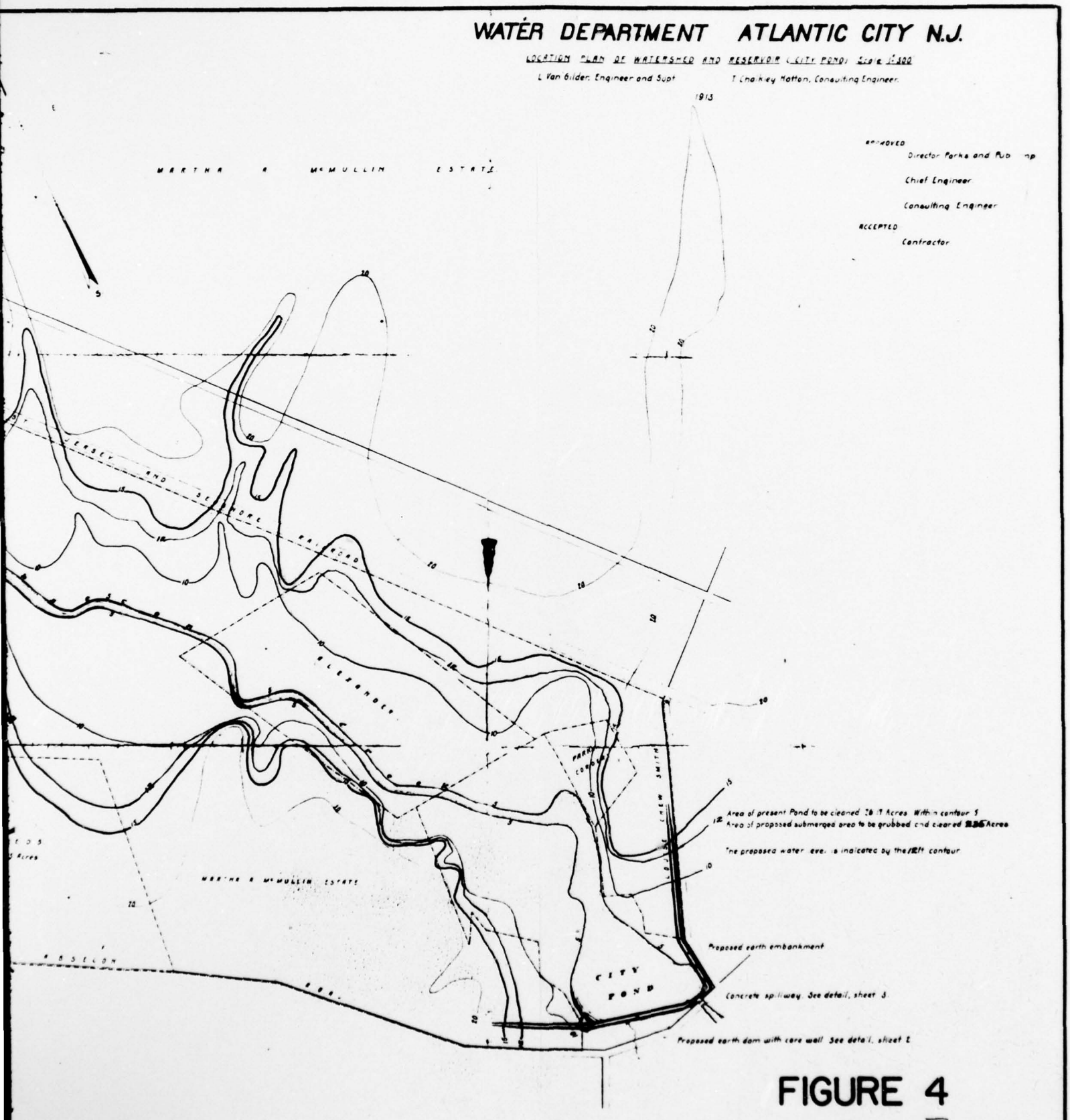
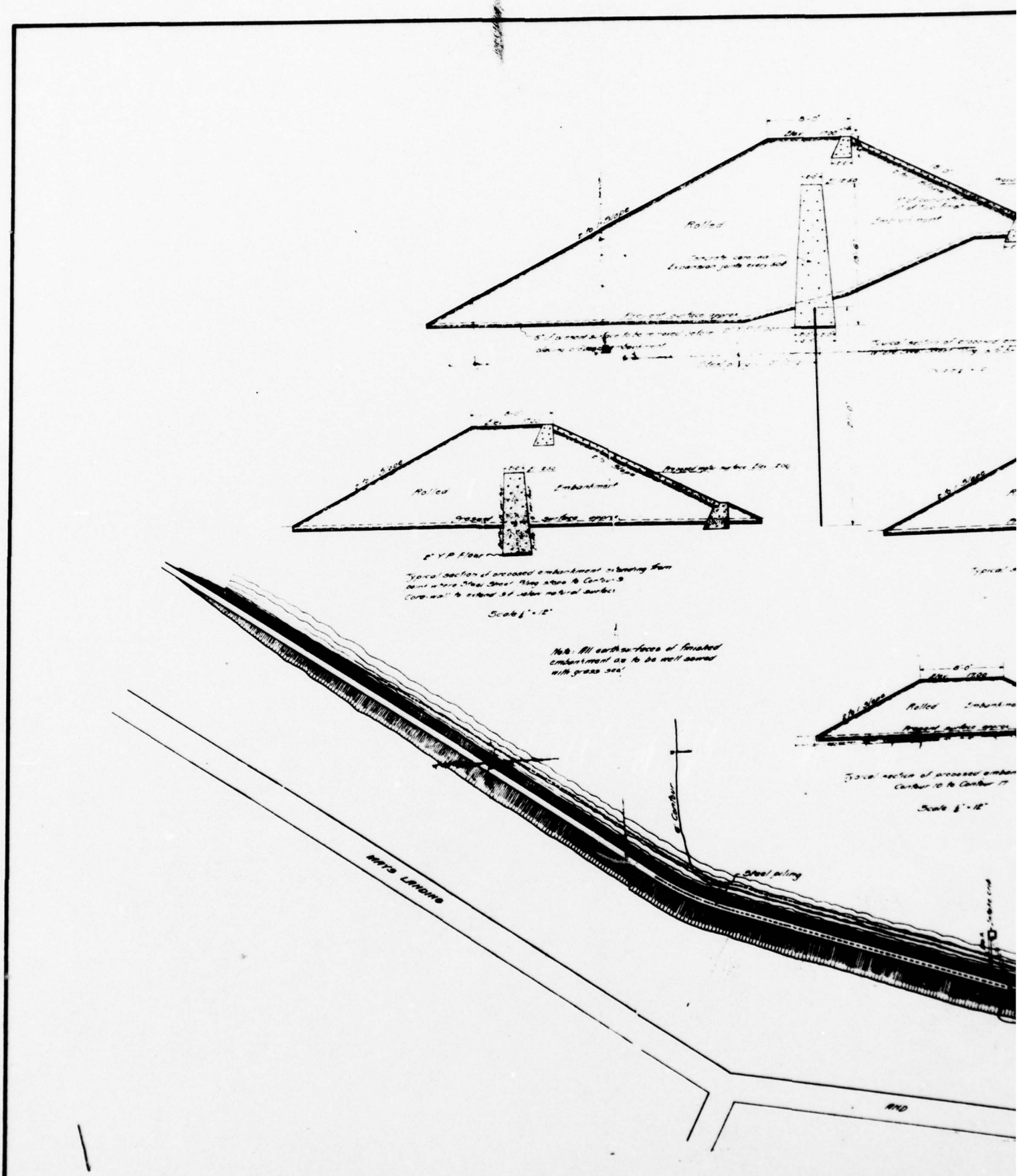

WATER DEPARTMENT ATLANTIC CITY N.J.
LOCATION PLAN OF WATERSHED AND RESERVOIR (CITY POND) Scale 1"=800
L Van Gilder, Engineer and Supt
T Chalkley Hatton, Consulting Engineer
1913
APPROVED
Director Parks and Pub ...np
Chief Engineer
Consulting Engineer
ACCEPTED
Contractor
MARTHA A McMULLIN ESTATE
Area of present Pond to be cleaned 28.1 Acres Within contour 5
Area of proposed submerged area to be grubbed and cleared 2.35 Acres
The proposed water level is indicated by the 12ft contour
Proposed earth embankment
Concrete spillway See detail, sheet 3
Proposed earth dam with core wall See detail, sheet 2
CITY POND
MARTHA A McMULLIN ESTATE

FIGURE 4

2


Rolled
Rolled
Embankment
Typical section of excavated embankment extending from
Scale 1" = 5'
Note: fill earth surfaces of finished
embankment as to be well covered
with grass seed
Steel piling
MAIN LANDING
RAMP

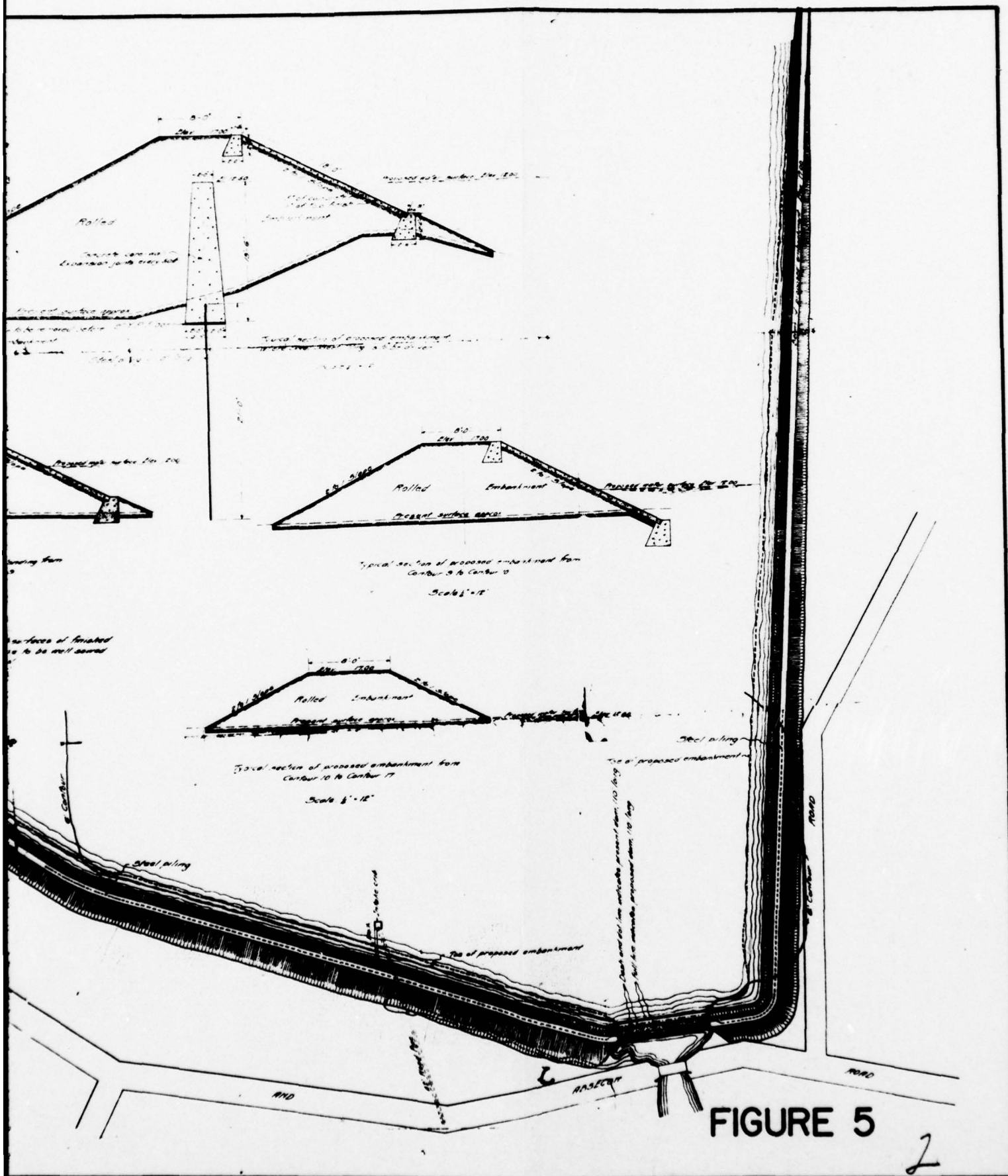
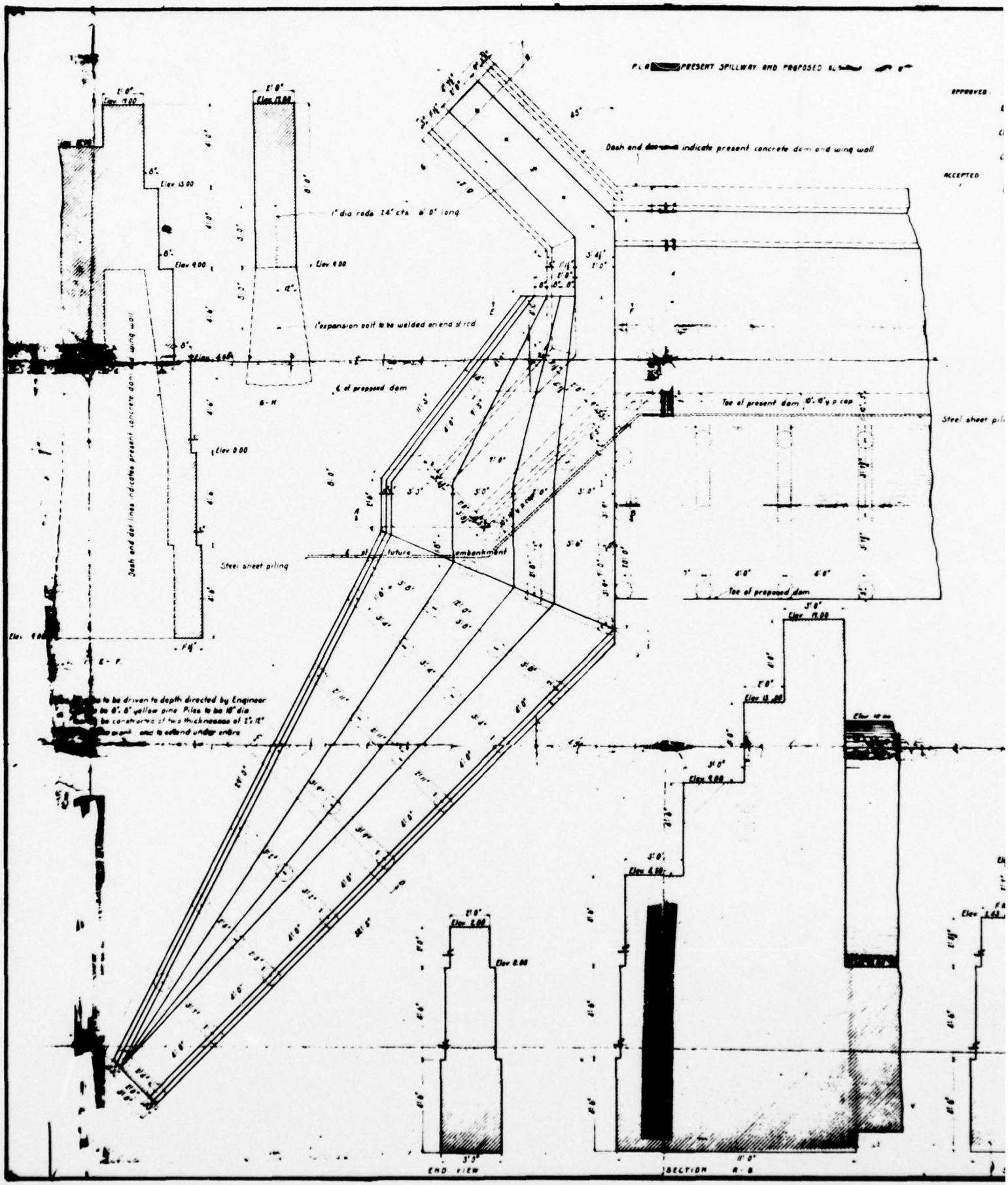

Rolled
Embankment
Typical section of proposed embankment from Contour 9 to Contour 10
Scale 1/4" = 1'
Typical section of proposed embankment from Contour 10 to Contour 11
Scale 1/4" = 1'
Steel piling
Toe of proposed embankment
ROAD
ROAD
ROAD

FIGURE 5

2


PLAN PRESENT SPILLWAY AND PROPOSED
APPROVED
ACCEPTED
Dash and dot lines indicate present concrete dam and wing wall
1" dia rods 24" cts 6' 0" long
1" expansion bolt to be welded on end of rod
℄ of proposed dam
Toe of present dam
Toe of proposed dam
Steel sheet piling
℄ of future embankment
Elev 9.00
Elev 13.00
Elev 4.50
Elev 0.00
END VIEW
SECTION A-B

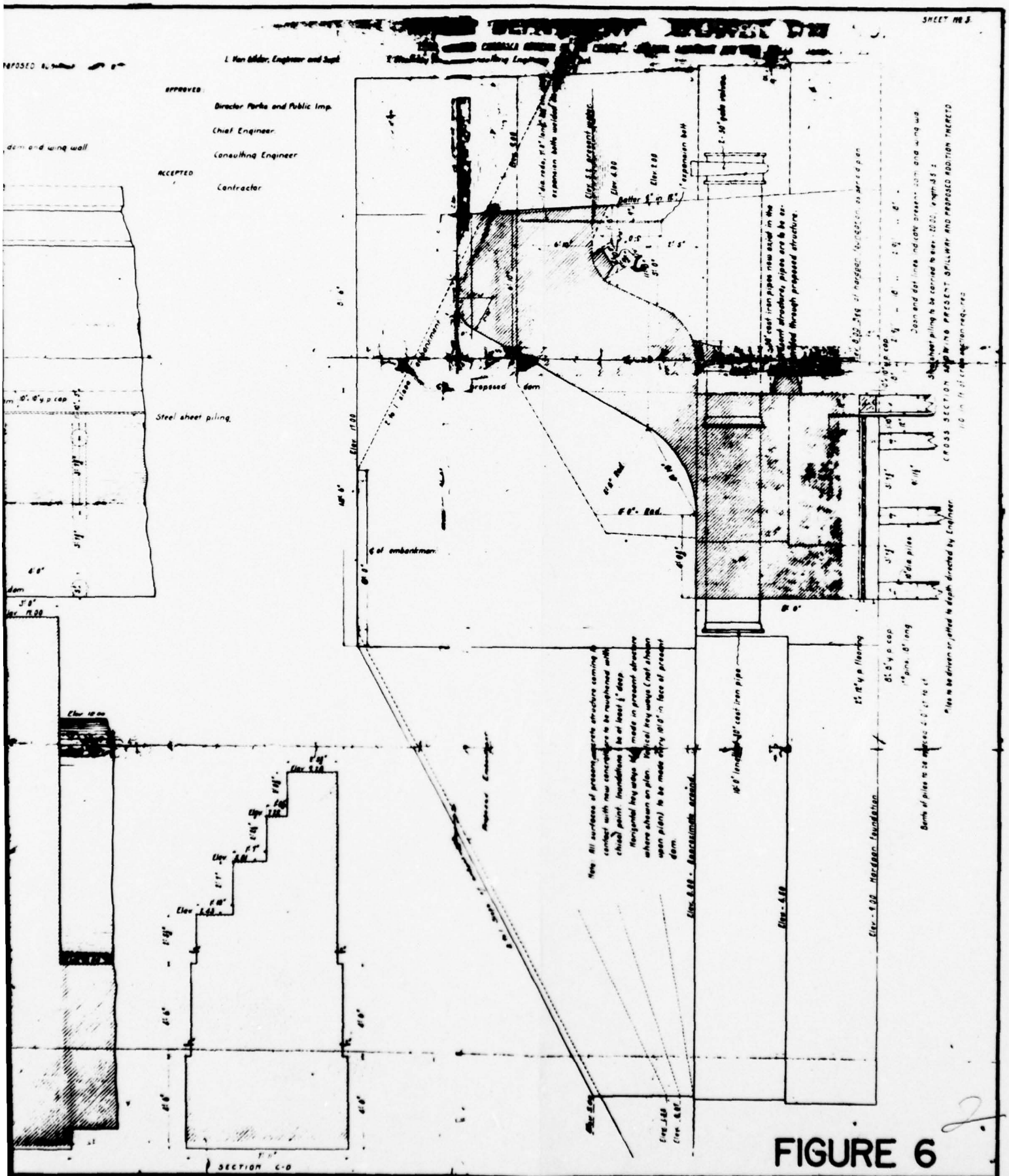
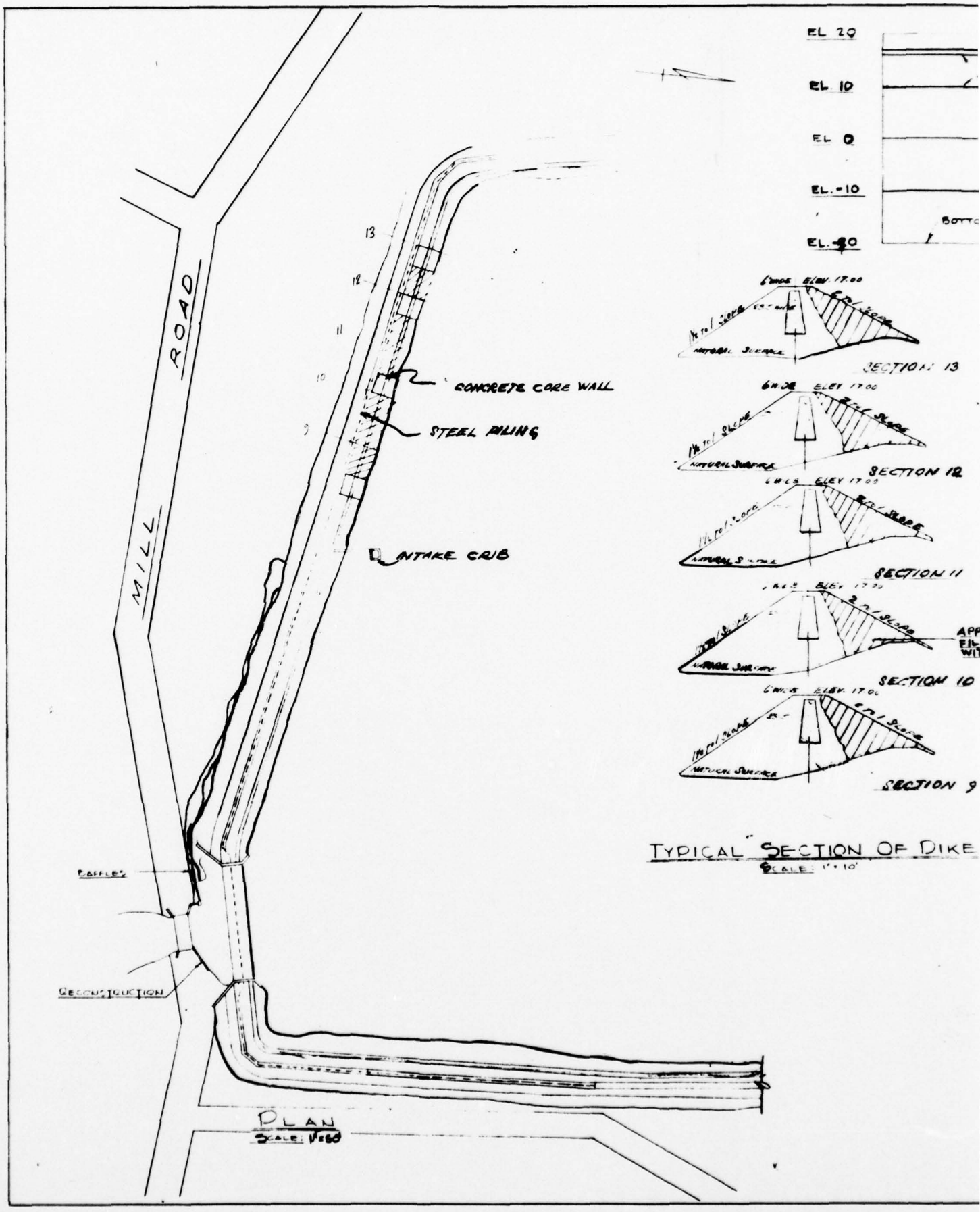
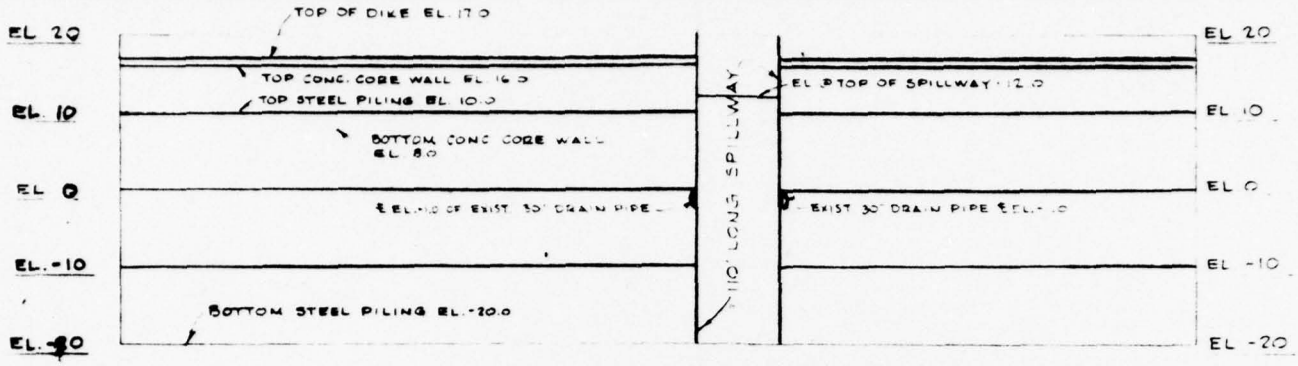

APPROVED
Director Parks and Public Imp.
Chief Engineer
Consulting Engineer
ACCEPTED
Contractor
Steel sheet piling
Proposed dam
SECTION C-D

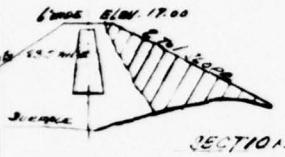
FIGURE 6


MILL ROAD
13
12
11
10
9
CONCRETE CORE WALL
STEEL PILING
INTAKE CRIB
BAFFLES
RECONSTRUCTION
PLAN
SCALE: 1"=60'
EL 20
EL 10
EL 0
EL.-10
EL.-20
SECTION 13
SECTION 12
SECTION 11
SECTION 10
SECTION 9
TYPICAL SECTION OF DIKE
SCALE: 1"=10'

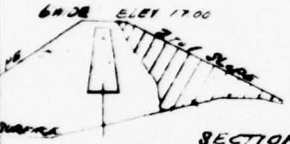


LONGITUDINAL SECTION ALONG DIKE

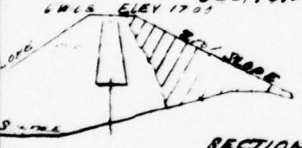
SCALES: HORZ. 1" = 10'
VERT. 1" = 10'



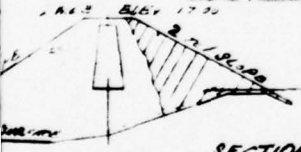
SECTION 13



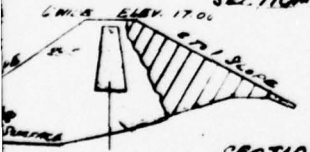
SECTION 12



SECTION 11



SECTION 10



SECTION 9

SECTION OF DIKE

SCALE: 1" = 10'

NOTES:

1. DIKE REPAIRS ARE AS FOLLOWS: FILL MATERIAL, FIXING CONCRETE HOLES ON SLABS AND SLAB JOINTS, REPLACEMENT OF DISINTEGRATED CONCRETE INCLUDING GROUTING AND SLAB REPLACEMENT AS REQUIRED BY THE ENGINEER.
2. REHABILITATE DETERIORATED CONCRETE AT BAFFLE WALLS IN FRONT OF DAM AS REQUIRED.
3. RECONSTRUCT FALLEN BAFFLE WALL (20'-0").

Dam Appn. No. 248

FEB 23 1970

Dept. Environmental Protection
Div. Water Resources
Sub. Water Control

FIGURE 7

(2) REPAIRS TO DOUGHTY POND

REMINGTON & BOYD, ENGINEERS
PENNSAUKEN, NEW JERSEY

REPAIRS TO WATER SUPPLY RESERVOIRS
DOUGHTY POND & RUSHMILE POND
OF BONGO WATER FILTRATION PLANT
CITY OF ATLANTIC CITY, ATLANTIC CO., N.J.

KENNETH R. REMINGTON
LIC. NO. 6634 — DATE 10-2-74

DATE: Oct. 74 | JOB NO. 7030 | DRAWING NO. A-710

2

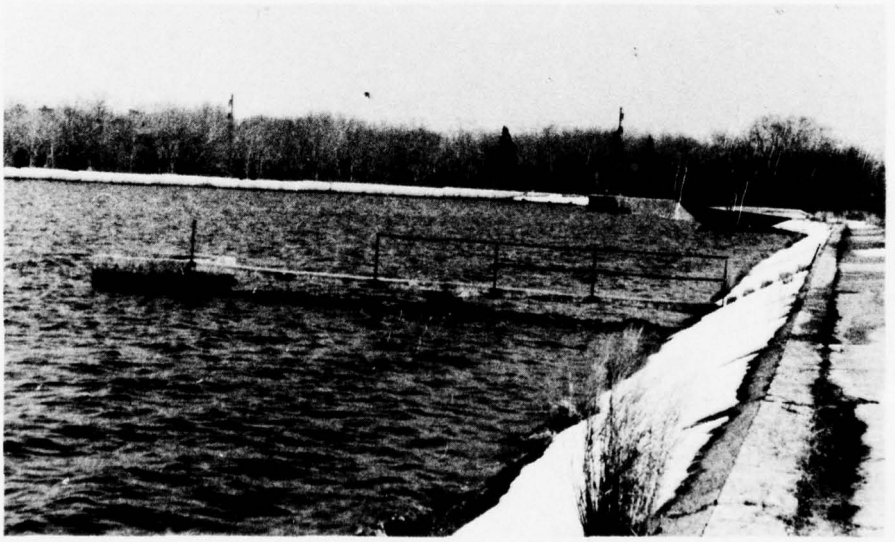
APPENDIX

PHOTOGRAPHS

VIEW OF UPSTREAM FACE SHOWING AREAS OF SLOPE FAILURE

CLOSEUP OF UPSTREAM SLOPE FAILURE

CHANNEL DOWNSTREAM OF SPILLWAY



WATER SUPPLY INTAKE

FIELD INSPECTION REPORT

Check List
Visual Inspection
Phase 1

Name Dam Absalom Doughty Dam County Atlantic State New Jersey Coordinators Mr. Larry Woscyna, New Jersey DEP

Date(s) Inspection 3/17/78 Weather Clear Temperature 30°

Pool Elevation at Time of Inspection 12.3 M.S.L. Tailwater at Time of Inspection --- M.S.L.

Inspection Personnel:

Mr. John J. Williams
Mr. David Campbell
Mr. Lee DeHeer
Mr. George Elias

Mr. David Campbell Recorder

Accompanied by:

Mr. Anthony J. Iarrobino, Soils Engineer, Technical Engineering Division, U.S. Army Corps of Engineers, New York Division
Col. Weinberg, Reserve Officer, U.S. Army Corps of Engineers, New York Division
Mr. Larry Woscyna, Civil Engineer, New Jersey Department of Environmental Protection

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Noted	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Noted	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Local embankment erosion up to 3 feet was noted where the concrete slab slope protection has been dislodged. At one point, the remaining top width is less than 2 feet. An unknown amount of settlement and erosion has occurred where the slabs are intact.	The embankment is in poor condition and is in need of considerable repair.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	In the overbank section at the far right end of the dam is a 50-foot section where the embankment was removed or omitted. The ground elevation is about 3 feet below the top of dam. There is no channel below the opening.	Discharge through the opening would flow through a wooded area parallel to the dam and could cause erosion of the downstream toe.
RIPRAP FAILURES	Concrete slabs were used for slope protection. Several slabs have collapsed after considerable embankment settling.	The concrete slab slope protection is in need of repair.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Settlement has occurred next to both spillway abutments. Concrete slabs for embankment protection are cracked, spalled and settled.	Considerable settlement of the embankments has occurred.
ANY NOTICEABLE SEEPAGE	Ponding of water up to 2 feet deep was observed downstream of the toe. Ponds extend from about 400 feet to the right of the spillway to the far right end of the embankment.	Ponding may be due to snowmelt, but should be observed over a period of time to determine if it is seepage water.
STAFF GAGE AND RECORDER	United States Geological Survey Gaging Station #01410500 (Water-Stage recorder).	Located next to stilling basin. May be inaccurate due to leakage through cracks in basin wall.
DRAINS	None Noted	None

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Conduit is subsurface.	None
INTAKE STRUCTURE	Water supply intake structure and the walkway to the structure are badly cracked and spalled. Some lengths of the hand railing are missing.	Repair or replacement of the structure should be implemented as merited.
OUTLET STRUCTURE	Thirty-inch blowoff lines are located under the spillway near each abutment. The operating assemblies for these lines are not in place.	The operating assemblies should be permanently in place to allow emergency operation.
OUTLET CHANNEL	Same as spillway discharge channel.	None
EMERGENCY GATE	None	None

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The floor of the spillway section appeared in good condition, though several inches of water was flowing across it. The concrete abutments were badly cracked and spalled.	Remedial work should be performed as necessary on the concrete of the abutments.
APPROACH CHANNEL	None	None
DISCHARGE CHANNEL	Absecon Creek is a tidal channel traversing a wide, flat marsh.	See next page.
BRIDGE AND PIERS	None	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel of Absecon Creek is incised in a wide, flat marshland above Absecon Bay. A bridge with an opening of about 250 square ft. is located about 100 ft. downstream of the spillway.	None
SLOPES	Slopes are very mild.	None
APPROXIMATE NO. OF HOMES AND POPULATION	The floodplain directly downstream is a very wide tidal marsh. Homes are located only along the perimeter of the marsh and most appear to be above expected flood levels. About 20 dwellings are located along the marsh within 2 miles of the dam.	None

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Very gentle slopes. No structures along the reservoir.	None
SEDIMENTATION	No visible signs of sedimentation.	None

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	The inspection report of 1942 indicated that gunite repairs had recently been completed on the spillway and abutments.
HIGH POOL RECORDS	None available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Inspection reports were filed by Joseph Dehnick in May of 1968, and by John Brooks in April, 1942. A study was prepared by Remington and Boyd Engineers, of Pennsauken, N.J., 1976. The study delineated proposed repairs to Absalom Doughty Dam and Upper Doughty Dam. Report information is included in the appendix.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known to have occurred.
MAINTENANCE OPERATION RECORDS	Average monthly water supply withdrawal rates from Water Resources Data for New Jersey, Part 1. Surface Water Records, 1974.

ITEM	REMARKS
DESIGN REPORTS	No design reports are available. The only available design information was three drawings for the proposed increase in height to Absalom Doughty Dam, dated 1914.
GEOLOGY REPORTS	See Section 6.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	½ PMF - Inflows and outflow peaks - 11,000 cfs (5.8 feet above spillway crest). This discharge overtops the dam. 500 year flood - Doughty Pond Upper Dam overtops and Absalom Doughty Dam overtops if a failure of Doughty Pond Upper Dam is assumed. The safety of the dam is questionable, even for normal pool elevations. No seepage studies were made.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None
POST-CONSTRUCTION SURVEYS OF DAM	None Available
BORROW SOURCES.	Local

HYDROLOGIC AND HYDRAULIC CALCULATIONS

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 1 OF _____
DATE 3/22/78
COMP. BY DEC
CHECKED BY LCW

NAME OF CLIENT Corps of Engrs.
PROJECT Upper Doughty Dam

DRAINAGE AREA = 8.7 SQ. MI.

UNIT HYDROGRAPH

ESTIMATION OF T_c

BUREAU OF PUBLIC ROADS

$$T_c = \left(\frac{11.9\,L^3}{H}\right)^{.385} \qquad L = 4.55 \text{ MILES}, H = 50 \text{ FEET}$$

T_c = 3.31 HOURS = 200 MINUTES

UPLANDS METHOD

AVERAGE OVERLAND SLOPE = .4%

OVERLAND LENGTH = 4000 FEET

OVERLAND

VELOCITY = .25 FPS

T_t = 4000 FEET / .25 FPS = 16,000 SEC = 4.44 HOURS

CHANNEL LENGTH = 20,000 FEET

AVERAGE SLOPE = .0017

CHANNEL

AVERAGE 'n' VALUE = .04

R = 1.5 FEET $\therefore V = \frac{1.5}{n} R^{2/3} S^{1/2}$ = 2.45 FPS

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 2 OF
DATE 3/23/78
NAME OF CLIENT CORPS OF ENGRS.
COMP. BY DBC
PROJECT UPPER DOUGHTY DAM
CHECKED BY LW

T_{t2} = 20,000 FEET / 2.45 FPS = 8160 SEC ≈ 2.27 HOURS

$T_C = T_{t1} + T_{t2}$ = 4.44 + 2.27 ≈ 6.7 HOURS ≈ 400 MIN.

USE UPLAND METHOD

T_C = 6.7 HOURS = 403 MIN

HYDROGRAPH PARAMETERS

$T_P = D/2 + .6\,T_C$ & $D \simeq .15\,T_C \simeq 1$ HOUR OR 60 MIN

T_P = 30 + .6 × 450 = 300 MINUTES

$q_P = 484 A / T_P$ = 842 CFS

RUNOFF CURVE NUMBER

SOIL IS PRIMARILY RESIDUAL SANDS & GRAVELS, EVIDENCE OF UNDERLYING HARDPAN. (SOIL GROUP B).

15%	IMPERVIOUS	95
5%	MARSH	85
20%	MEADOW (FAIR)	62
55%	WOODLAND (POOR)	63
5%	RESERVOIR	99

AVERAGE CN = .15 × 95 + .05 × 85 + .20 × 62 + .55 × 63 + .05 × 99

= 71

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 3 OF

NAME OF CLIENT CORPS OF ENGRS.

DATE 3/23/79

PROJECT UPPER DUQUESNE DAM

COMP. BY DBC

CHECKED BY LW

T/Tp	Q/Qp	T (HOURS)	Qa (CFS)	q (adjusted)
0	0.00	0	0	0
.1	0.015	.5	13	13
.2	0.075	1.0	63	62
.3	0.16	1.5	135	133
.4	0.28	2.0	236	232
.5	0.43	2.5	362	356
.6	0.60	3.0	505	497
.7	0.77	3.5	648	638
.8	0.89	4.0	750	738
.9	0.97	4.5	817	804
1.0	1.00	5.0	842	829
1.1	0.98	5.5	825	812
1.2	0.92	6.0	775	763
1.3	0.84	6.5	707	696
1.4	0.75	7.0	632	622
1.5	0.66	7.5	556	547
1.6	0.56	8.0	472	465
1.8	0.42	9.0	354	348
2.0	0.32	10.0	269	265
2.2	0.24	11.0	202	199
2.4	0.18	12.0	152	150
2.6	0.13	13.0	109	107
2.8	0.098	14.0	82	82
3.0	0.075	15.0	63	62
3.5	0.036	17.5	30	30
4.0	0.018	20.0	15	15
4.5	0.009	22.5	8	8
5.0	0.004	25.0	3	3
5.5	0.00	27.5	0	0

1.016"

1"

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 4 OF _____

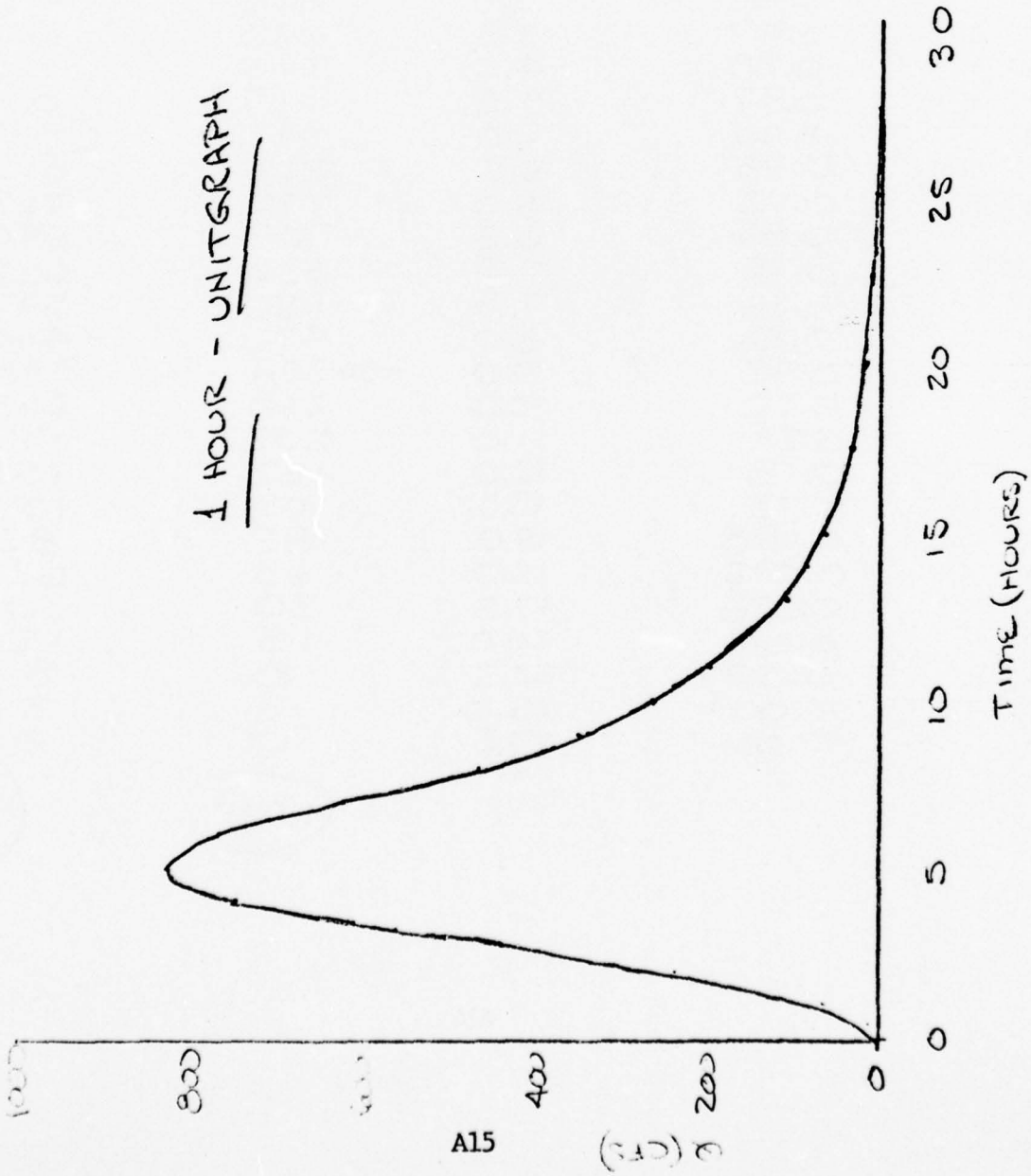
NAME OF CLIENT CORPS OF ENGRS.

DATE 3/23/78

PROJECT UPPER DOUGHTY DAM

COMP. BY DBC

CHECKED BY LW



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. _____ OF _____

NAME OF CLIENT Corps of Engrs

DATE 4/31/75

PROJECT Upper Dunkard Dam

COMP. BY DJC

CHECKED BY LW

1/2 PMF FLOOD COMPUTATION (UPPER DAM)

6HR PMP RAINFALL = 26"

20% REDUCTION FACTOR FOR PROBABLE MISALIGNMENT OF BASIN AND STORM ISOHYETALS, SO —

ADJUSTED 6HR PMP = 20.8"

TIME (HOURS)	PMP RAINFALL ‡ %	Σ	Incr.	RUNOFF Σ	Incr	Losses Σ	Incr.
1	8	1.7	1.7	.2	.2	1.5	1.5
2	9	3.5	1.8	1.1	.9	2.4	.9
3	11	5.8	2.3	2.7	1.6	3.1	.7
4	49	16.0	10.2	12.0	9.3	4.0	.9
5	15	19.1	3.1	14.9	2.9	4.2	.2 *
6	8	20.8	1.7	16.4	1.5	4.4	.2 *

‡ THIRD QUARTILE
* MINIMUM LOSS RATE

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 7 OF
DATE 3/24/78
COMP. BY DC
CHECKED BY LW

NAME OF CLIENT CORPS OF ENGINEERS
PROJECT UPPER DOUGHTY DAM

STAGE - STORAGE RELATION

AREA @ ELEV 25 = 130 ACRES
AREA @ ELEV 30 = 300 ACRES
} FROM USGS QUAD

ASSUME A LINEAR VARIATION IN SURFACE AREA FROM ELEV 25 TO ELEV 30

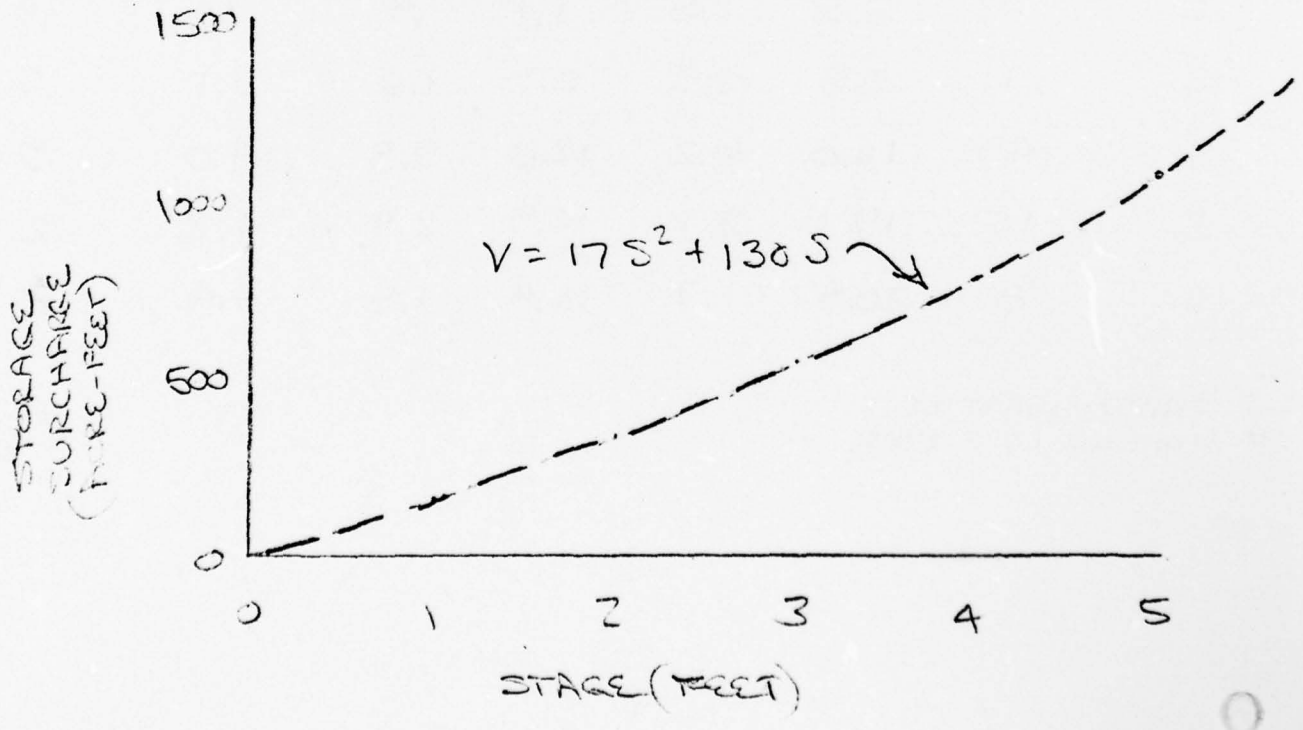
Let STAGE(S) = 0 @ ELEV = 25

$A(0) = 130 \qquad A(5) = 300$

$\therefore A = 34S + 130$

$V = \int_0^S (34S + 130)\,dS = 17S^2 + 130S + C$

$V(0) = 0 \quad \therefore C = 0$



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 8 OF
DATE 3/24/78
COMP. BY DEC
CHECKED BY

NAME OF CLIENT CORPS OF ENGRS
PROJECT UPPER DOUGHTY DAM

STAGE - DISCHARGE RELATION

OVERFLOW SPILLWAY (BROAD-CRESTED)

25' WIDE WITH 1' WIDE BRIDGE PIER

EFFECTIVE WIDTH = 24'

VERTICAL OPENING IS 2' TO BRIDGE GIRDERS

$Q = CLH^{3/2}$ $C = 3.1$ $L = 24'$ $Q = 74.4 H^{3/2}$

FROM ELEV. 27' TO ELEV. 28' (PRESSURE FLOW)

$Q = CA\sqrt{2gH}$ $C = .55$

$Q = .55 \times 2 \times 24 \times \sqrt{2g} \times \sqrt{H} = 211 \times H^{.5}$

ABOVE ELEV. 28' PRESSURE FLOW AND WEIR FLOW ACROSS THE CREST OF DAM.

$L = 750'$ ✓ $C = 3.0$

$Q = CLH^{3/2} = 2250 H^{3/2}$

STAGE	DISCHARGE	STAGE	DISCHARGE
0	0	3.0	298
.5	26	4.0	2615
1.0	74	5.0	6786
1.5	137	6.0	12160
2.0	210	7.0	18520

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 9 OF
DATE 3/24/78
COMP. BY DBC
CHECKED BY LW

NAME OF CLIENT CORPS OF ENGRS.
PROJECT UPPER DOUGHTY DAM

STORAGE -DISCHARGE RELATION
(HEC-1 INPUT)

STORAGE	DISCHARGE
0	0
70	26
147	74
233	137
326	210
540	298
700	2615
1050	6786
1390	12160
1740	18520

½ PMF PEAK DISCHARGE FROM RESERVOIR IS ABOUT 5800CFS OR A STAGE OF 4.8 FEET (1.8 FEET ABOVE THE TOP OF DAM).

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 10 OF _____
DATE 2/23/78
COMP. BY DBC
CHECKED BY LW

NAME OF CLIENT CORPS OF ENGR.
PROJECT ABSOLEM DOUGHTY DAM

DRAINAGE AREA = 16.7 SQ. MI.

8.0 DIRECTLY TO ABSOLEM DOUGHTY
8.7 THROUGH UPPER DOUGHTY POND (pp. 1-9)

ESTIMATION OF T_c FOR DIRECT FLOW TO ABSOLEM DOUGHTY POND.

BUREAU OF PUBLIC ROADS

$$T_c = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

L = 4.92 MILES H = 63 FEET

T_c = 3.32 HOURS

UPLAND METHOD

(OVERLAND)

AVERAGE OVERLAND SLOPE ≈ .27%
OVERLAND LENGTH = 5000 FEET
VELOCITY ≈ .25 FPS
T_{t_1} = 5000/.25 FPS = 20000 sec = 5.55 HOURS

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 11 OF _____

NAME OF CLIENT _____ DATE _____

PROJECT _____ COMP. BY _____ CHECKED BY LW

(CHANNEL)

CHANNEL LENGTH = 21000 FEET

AVERAGE SLOPE = .00224

AVERAGE 'n' VALUE = .05

R = 3 FEET $V = \frac{1.50}{n} R^{2/3} S^{1/2} = 2.95$ FPS

T_{t_2} = 21000 FEET / 2.95 FPS = 7120 SEC = 1.95 HRS.

USE OVERLAND → $T_c = T_{t_1} + T_{t_2} = 7.5$ HOURS USE D = 1 HOUR

$T_P = D/2 + .6 \times T_c$

$T_P = .5 + .6 \times 7.5 = 5$ HOURS.

$q_P = 484 A / T_P = 774.4$ CFS

RUNOFF CURVE NUMBER

SOIL IS PRIMARILY RESIDUAL SANDS & GRAVELS, EVIDENCE OF UNDERLYING HARDPAN. (SOIL GROUP B)

		CN
50%	SFD (MEDIUM DENSITY)	80
5%	RESERVOIR	99
45%	WOODS & MEADOW (FAIR)	60

$\overline{CN} = .5 \times 80 + .05 \times 99 + .45 \times 60 = 72$

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 12 OF

NAME OF CLIENT Corps of Engrs

DATE 3/23/78

PROJECT Absolem Doughty Dam

COMP. BY DBC

CHECKED BY LW

T/Tp	q/qp	T (HOURS)	q (CFS)	q (adjusted)
0	.00	0	0	0
.1	.015	.5	11	11
.2	.075	1.0	58	57
.3	.16	1.5	123	122
.4	.28	2.0	216	214
.5	.43	2.5	332	328
.6	.60	3.0	464	458
.7	.77	3.5	596	588
.8	.89	4.0	689	680
.9	.97	4.5	751	741
1.0	1.00	5.0	774	764
1.1	.98	5.5	758	749
1.2	.92	6.0	712	703
1.3	.84	6.5	650	642
1.4	.75	7.0	580	573
1.5	.66	7.5	511	504
1.6	.56	8.0	433	428
1.8	.42	9.0	325	321
2.0	.32	10.0	247	244
2.2	.24	11.0	185	183
2.4	.18	12.0	139	137
2.6	.13	13.0	100	99
2.8	.098	14.0	75	74
3.0	.075	15.0	58	57
3.5	.036	17.5	27	27
4.0	.018	20.0	13	13
4.5	.009	22.5	6	6
5.0	.004	25.0	3	3
5.5	.00	27.5	0	0
			1.013"	(1")

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 13 OF _____

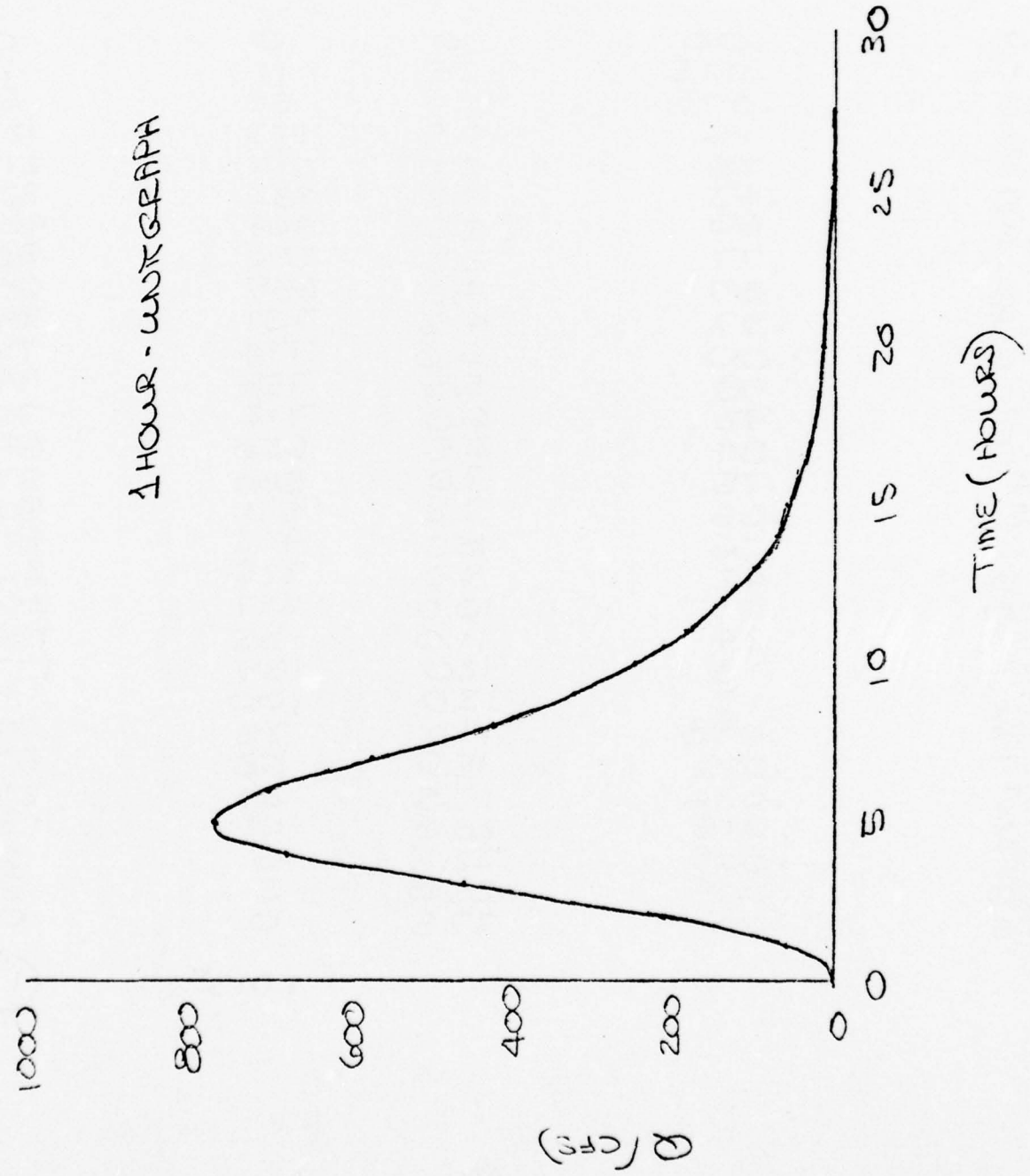
NAME OF CLIENT CORPS OF ENGRS.

DATE 3/24/75

PROJECT ABSOLEM DOUGHTY DAM

COMP. BY DBC

CHECKED BY LW



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 14 OF _____
DATE 3/25/78
COMP. BY DEC
CHECKED BY _____

NAME OF CLIENT Corps of Engrs
PROJECT Absalom Doughty Dam

1/2 PMF FLOOD COMPUTATION (LOWER DAM)

6HR PMP RAINFALL = 26"

20% REDUCTION FACTOR FOR PROBABLE MISALIGNMENT OF BASIN AND STORM ISOHYETALS, SO —

ADJUSTED 6HR PMP = 20.8"

TIME (HOURS)	PMP RAINFALL # %	PMP RAINFALL # Σ	PMP RAINFALL # Incr.	RUNOFF Σ	RUNOFF Incr.	LOSSES Σ	LOSSES Incr.
1	8	1.7	1.7	.2	.2	1.5	1.5
2	9	3.5	1.8	1.1	.9	2.4	.9
3	11	5.8	2.3	2.8	1.7	3.0	.6
4	49	16.0	10.2	12.1	9.3	3.9	.9
5	15	19.1	3.1	15.0	2.9	4.1	.2 *
6	8	20.8	1.7	16.5	1.5	4.3	.2 *

THIRD QUARTILE
* MINIMUN LOSS RATE

HOURLY PMP RUNOFF INCREMENTS	.2"	.9"	1.7"	9.3"	2.9"	1.5"
HOURLY 1/2 PMP " "	.1"	.45"	.85"	4.65"	1.45"	.75"

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 16 OF _____

NAME OF CLIENT CORPS OF ENGRS

DATE 3/25/78

PROJECT ABSALOM DOUGHTY DAM

COMP. BY DBC

CHECKED BY LW

STAGE - STORAGE RELATION

AREA @ ELEV. 9.0 ≈ 160 ACRES
AREA @ ELEV 20.0 ≈ 400 ACRES } *

*(FROM USGS QUAD)

ASSUME A LINEAR VARIATION IN SURFACE AREA FROM ELEV. 9 TO ELEV. 20.

$A(9) = 160$ & $A(20) = 400$

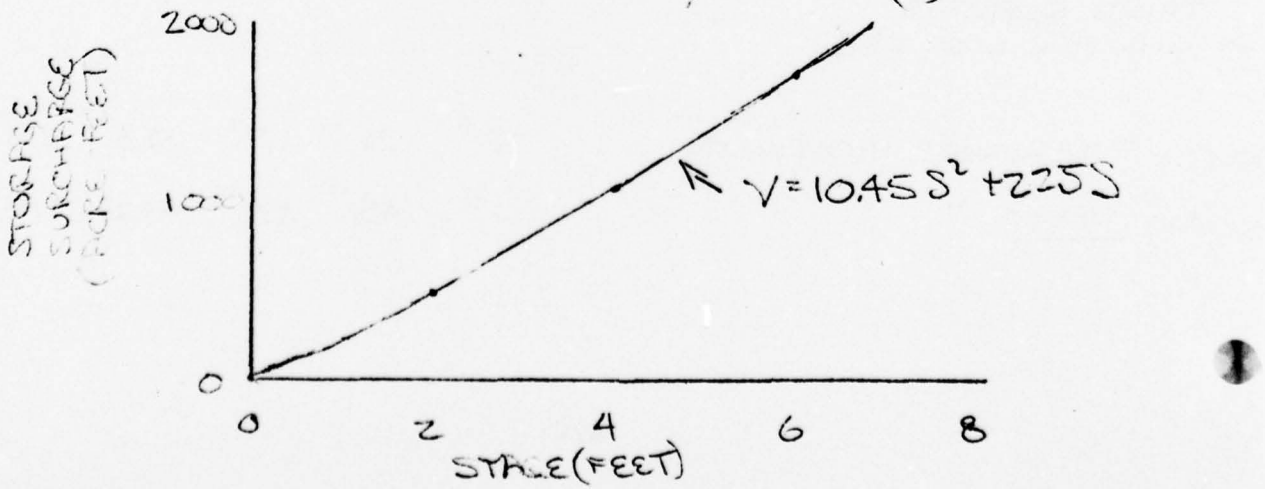
$\therefore A = 21.8Y - 36$ & $A(12) = 225$

Let Stage (S) = 0 @ Y = 12

$A(0) = 225$ & $A(8) = 400$

$\therefore A = 21.9S + 225$ & $V = \int_0^S (21.9S + 225)\,dS$

$V = 10.45S^2 + 225S + C$ (C → 0) $V(0) = 0 \therefore C = 0$



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 17 OF _____

NAME OF CLIENT CORPS OF ENGRS.

DATE 3/25/78

PROJECT ABSOLEM DOUGHTY DAM

COMP. BY DBC

CHECKED BY LW

STAGE - DISCHARGE RELATION

OVERFLOW SPILLWAY (BROAD CRESTED)

110' WIDE

$Q = CLH^{3/2}$ $C = 3.1$ $L = 110$

$\therefore Q = 341 H^{3/2}$ CREST ELEV. = 12.0

WEIR FLOW ACROSS THE CREST OF DAM. (ELEV. 17')

$L = 2800'$ $C = 2.9$

$Q = CLH^{3/2}$ $Q = 8100 H^{3/2}$

STAGE	DISCHARGE	STAGE	DISCHARGE
0	0	3.0	1772
.5	121	4.0	2728
1.0	341	5.0	3812
1.5	626	5.5	7262
2.0	964	6.0	13112

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 18 OF
DATE 3/25/78
COMP. BY DEC
CHECKED BY LW

NAME OF CLIENT CORPS OF ENGRS.
PROJECT ABSOLEM DOUGHTY DAM

STORAGE - DISCHARGE RELATION
(HEC-1 INPUT)

STORAGE	DISCHARGE
0	0
113	121
231	341
354	626
482	964
752	1772
1043	2728
1353	3812
1515	7262
1682	13112

1/2 PMF DISCHARGE FROM THE RESERVOIR IS ABOUT 11200 CFS, OR A STAGE OF 5.85 FEET (.85 FEET ABOVE THE TOP OF DAM.

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 10 OF _____
DATE 4/10/78
COMP. BY DBC
CHECKED BY _____

NAME OF CLIENT CORPS OF ENGRS.
PROJECT ABSALOM DOUGHTY DAM

RESERVOIR DRAWDOWN – TWO 30" C.I.P.

ASSUME OUTLET CONTROL & CULVERT FLOWING FULL

$$H = \left(1 + K_e + K_v + \frac{29n^2L}{R_h^{1.33}}\right)\frac{V^2}{2g} \quad \& \quad \frac{V^2}{2g} = \frac{Q^2}{\frac{2g\pi D^2}{4}}$$

$$H = \left(1 + .1 + .1 + \frac{29 \times .01^2 \times 24}{\left(\frac{2.5}{4}\right)^{1.33}}\right)\frac{Q^2}{\frac{2g\pi (2.5)^2}{4}} \qquad H = .00421Q^2$$

$Q = 15.4H^{1/2}$ per pipe) $\qquad Q_T = 30.8H^{1/2}$

H feet	12	10	8	6	4
Q cfs	111	102	92	81	69

ASSUME A SURFACE AREA PROPORTIONAL TO THE HEAD(H) WITH A(0) = 0 & A(12) = 225 ACRES

$$A = KH \quad \& \quad K = \frac{225}{10} = 22.5$$

H (FEET)	ΔH (FEET)	Q_{AVE} (CFS)	AREA AVE ACRES	Δt (HOURS)	Σt (HOURS)
12	2	111	203	44	44
10	2	102	158	37	81
8	2	92	113	30	111
6	2	81	68	20	131
4	2	69	23	8	139

****
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****

DOUGHTY DAMS
NATIONAL DAM SAFETY PROGRAM
ONE HALF PROBABLE MAXIMUM FLOOD COMPUTATION

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
50	1	0	1	0	0	0	2	2	0

JOPER NWT
3 0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	8.70	0.00	0.00	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
6	0.00	0.00	0.00

PRECIP PATTERN

.10 .45 .80 4.65 1.45 .75

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

GIVEN UNIT GRAPH, NUHGO= 28

0.	62.	232.	497.	738.	829.	763.	622.	465.	348.
265.	199.	150.	107.	82.	62.	49.	36.	27.	21.
15.	12.	9.	7.	5.	3.	2.	0.		

UNIT GRAPH TOTALS 5607. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	1 0	.10	.10	0.
1	2 0	.45	.45	6.
1	3 0	.80	.80	51.
1	4 0	4.65	4.65	204.
1	5 0	1.45	1.45	771.
1	6 0	.75	.75	1981.
1	7 0	0.00	0.00	3734.
1	8 0	0.00	0.00	5395.
1	9 0	0.00	0.00	6234.
1	10 0	0.00	0.00	6045.
1	11 0	0.00	0.00	5176.
1	12 0	0.00	0.00	4054.
1	13 0	0.00	0.00	3076.
1	14 0	0.00	0.00	2323.

1	15	J	0.00	0.00	1747.
1	16	0	0.00	0.00	1314.
1	17	0	0.00	0.00	963.
1	18	0	0.00	0.00	724.
1	19	0	0.00	0.00	546.
1	20	0	0.00	0.00	422.
1	21	0	0.00	0.00	318.
1	22	0	0.00	0.00	239.
1	23	0	0.00	0.00	182.
2	0	0	0.00	0.00	135.
2	1	0	0.00	0.00	104.
2	2	0	0.00	0.00	79.
2	3	0	0.00	0.00	60.
2	4	0	0.00	0.00	43.
2	5	0	0.00	0.00	29.
2	6	0	0.00	0.00	17.
2	7	0	0.00	0.00	5.
2	8	0	0.00	0.00	2.
2	9	0	0.00	0.00	0.
2	10	0	0.00	0.00	0.
2	11	0	0.00	0.00	0.
2	12	0	0.00	0.00	0.
2	13	0	0.00	0.00	0.
2	14	0	0.00	0.00	0.
2	15	0	0.00	0.00	0.
2	16	0	0.00	0.00	0.
2	17	0	0.00	0.00	0.
2	18	0	0.00	0.00	0.
2	19	0	0.00	0.00	0.
2	20	0	0.00	0.00	0.
2	21	0	0.00	0.00	0.
2	22	0	0.00	0.00	0.
2	23	0	0.00	0.00	0.
3	0	0	0.00	0.00	0.
3	1	0	0.00	0.00	0.
3	2	0	0.00	0.00	0.
		SUM	8.20	8.20	45974.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6234.	5106.	1909.	920.	45977.
INCHES		5.46	8.17	8.19	8.19
AC-FT		2533.	3789.	3802.	3802.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

STORAGE=	0.	70.	147.	233.	326.	428.	537.	655.	780.	1050.
OUTFLOW=	0.	26.	74.	137.	210.	253.	298.	1129.	2615.	6786.

TIME	EOP STOR	AVG IN	EOP OUT
1 1 0	0.	0.	0.
1 2 0	0	0	0

1	5	0	52.	488.	19.
1	6	0	162.	1376.	85.
1	7	0	384.	2858.	238.
1	8	0	689.	4564.	1529.
1	9	0	913.	5815.	4670.
1	10	0	987.	6140.	5815.
1	11	0	977.	5610.	5656.
1	12	0	924.	4615.	4844.
1	13	0	860.	3565.	3847.
1	14	0	802.	2699.	2953.
1	15	0	753.	2035.	2296.
1	16	0	711.	1530.	1731.
1	17	0	675.	1138.	1361.
1	18	0	644.	843.	1054.
1	19	0	618.	635.	865.
1	20	0	593.	484.	693.
1	21	0	572.	370.	548.
1	22	0	555.	278.	426.
1	23	0	541.	211.	329.
2	0	0	529.	158.	295.
2	1	0	514.	119.	290.
2	2	0	498.	91.	284.
2	3	0	481.	69.	277.
2	4	0	462.	52.	271.
2	5	0	443.	36.	264.
2	6	0	424.	23.	256.
2	7	0	404.	11.	247.
2	8	0	384.	3.	237.
2	9	0	365.	1.	228.
2	10	0	346.	0.	220.
2	11	0	329.	0.	211.
2	12	0	312.	0.	199.
2	13	0	296.	0.	186.
2	14	0	281.	0.	175.
2	15	0	267.	0.	164.
2	16	0	254.	0.	153.
2	17	0	242.	0.	144.
2	18	0	230.	0.	135.
2	19	0	219.	0.	127.
2	20	0	209.	0.	119.
2	21	0	199.	0.	112.
2	22	0	190.	0.	106.
2	23	0	182.	0.	100.
3	0	0	174.	0.	94.
3	1	0	166.	0.	88.
3	2	0	159.	0.	83.
		SUM			44091.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5815.	4631.	1703.	882.	44091.
INCHES		4.95	7.28	7.85	7.85
AC-FT		2298.	3379.	3646.	3646.

STATION 2

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

0. 1000. 2000. 3000. 4000. 5000. 6000. 7000. 0. 0. 0. 0. 0.

1	1	OI
1	2	OI
1	3	OI
1	4	OOI
1	5	OO I
1	6	O.O I
1	7	O. O I.
1	8	O. O I
1	9	O. O I
1	10	O. O .I
1	11	O. IO
1	12	O. I O
1	13	O. I O
1	14	O. I O
1	15	O. I O
1	16	O. I O
1	17	O. I O
1	18	O. I O
1	19	O. I O.
1	20	O. I O
1	21	O. IO
1	22	O. IO
1	23	O. IO
2	0	O. IO
2	1	O.I O
2	2	O.I O
2	3	O.I O
2	4	O.I O
2	5	OI O
2	6	OI O
2	7	OI O
2	8	OI O
2	9	OI O
2	10	OI O
2	11	OI O
2	12	OI O
2	13	OI O
2	14	OI O
2	15	OI O
2	16	OI O
2	17	OIO
2	18	OIO
2	19	OIO
2	20	OIO
2	21	OIO
2	22	OIO
2	23	OIO
3	0	OIO
3	1	OIO
3	2	OIO

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	8.00	0.00	0.00	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
6	0.00	0.00	0.00

PRECIP PATTERN

.10	.45	.85	4.65	1.45	.75

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

GIVEN UNIT GRAPH, NUHGQ= 28

0.	57.	214.	458.	680.	764.	703.	573.	428.	321.
244.	183.	137.	99.	74.	57.	45.	33.	24.	19.
13.	10.	7.	5.	3.	2.	1.	0.		

UNIT GRAPH TOTALS 5154. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	1 0	.10	.10	0.
1	2 0	.45	.45	6.
1	3 0	.85	.85	47.
1	4 0	4.65	4.65	191.
1	5 0	1.45	1.45	721.
1	6 0	.75	.75	1843.
1	7 0	0.00	0.00	3475.
1	8 0	0.00	0.00	5010.
1	9 0	0.00	0.00	5780.
1	10 0	0.00	0.00	5599.
1	11 0	0.00	0.00	4789.
1	12 0	0.00	0.00	3749.
1	13 0	0.00	0.00	2846.
1	14 0	0.00	0.00	2148.
1	15 0	0.00	0.00	1614.
1	16 0	0.00	0.00	1209.
1	17 0	0.00	0.00	889.
1	18 0	0.00	0.00	662.
1	19 0	0.00	0.00	502.
1	20 0	0.00	0.00	388.
1	21 0	0.00	0.00	292.
1	22 0	0.00	0.00	216.
1	23 0	0.00	0.00	164.
2	0 0	0.00	0.00	118.
2	1 0	0.00	0.00	88.
2	2 0	0.00	0.00	63.
2	3 0	0.00	0.00	44.

2	5	0	0.00	0.00	18.
2	6	0	0.00	0.00	10.
2	7	0	0.00	0.00	3.
2	8	0	0.00	0.00	1.
2	9	0	0.00	0.00	0.
2	10	0	0.00	0.00	0.
2	11	0	0.00	0.00	0.
2	12	0	0.00	0.00	0.
2	13	0	0.00	0.00	0.
2	14	0	0.00	0.00	0.
2	15	0	0.00	0.00	0.
2	16	0	0.00	0.00	0.
2	17	0	0.00	0.00	0.
2	18	0	0.00	0.00	0.
2	19	0	0.00	0.00	0.
2	20	0	0.00	0.00	0.
2	21	0	0.00	0.00	0.
2	22	0	0.00	0.00	0.
2	23	0	0.00	0.00	0.
3	0	0	0.00	0.00	0.
3	1	0	0.00	0.00	0.
3	2	0	0.00	0.00	0.
		SUM	8.25	8.25	42519.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5780.	4734.	1767.	850.	42520.
INCHES		5.50	8.22	8.24	8.24
AC-FT		2348.	3507.	3516.	3516.

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT 4

0.	6.	48.	195.	740.	1934.	3712.	6539.	10451.	11414.
10445.	8594.	6634.	5101.	3910.	3000.	2250.	1717.	1367.	1082.
839.	642.	493.	413.	378.	346.	322.	299.	282.	266.
250.	238.	228.	220.	211.	199.	186.	175.	164.	153.
144.	135.	127.	119.	112.	105.	100.	94.	88.	83.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11414.	9023.	3445.	1732.	86611.
INCHES		5.03	7.68	8.04	8.04
AC-FT		4476.	6837.	7162.	7162.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.000	0.000	0.000	-1.

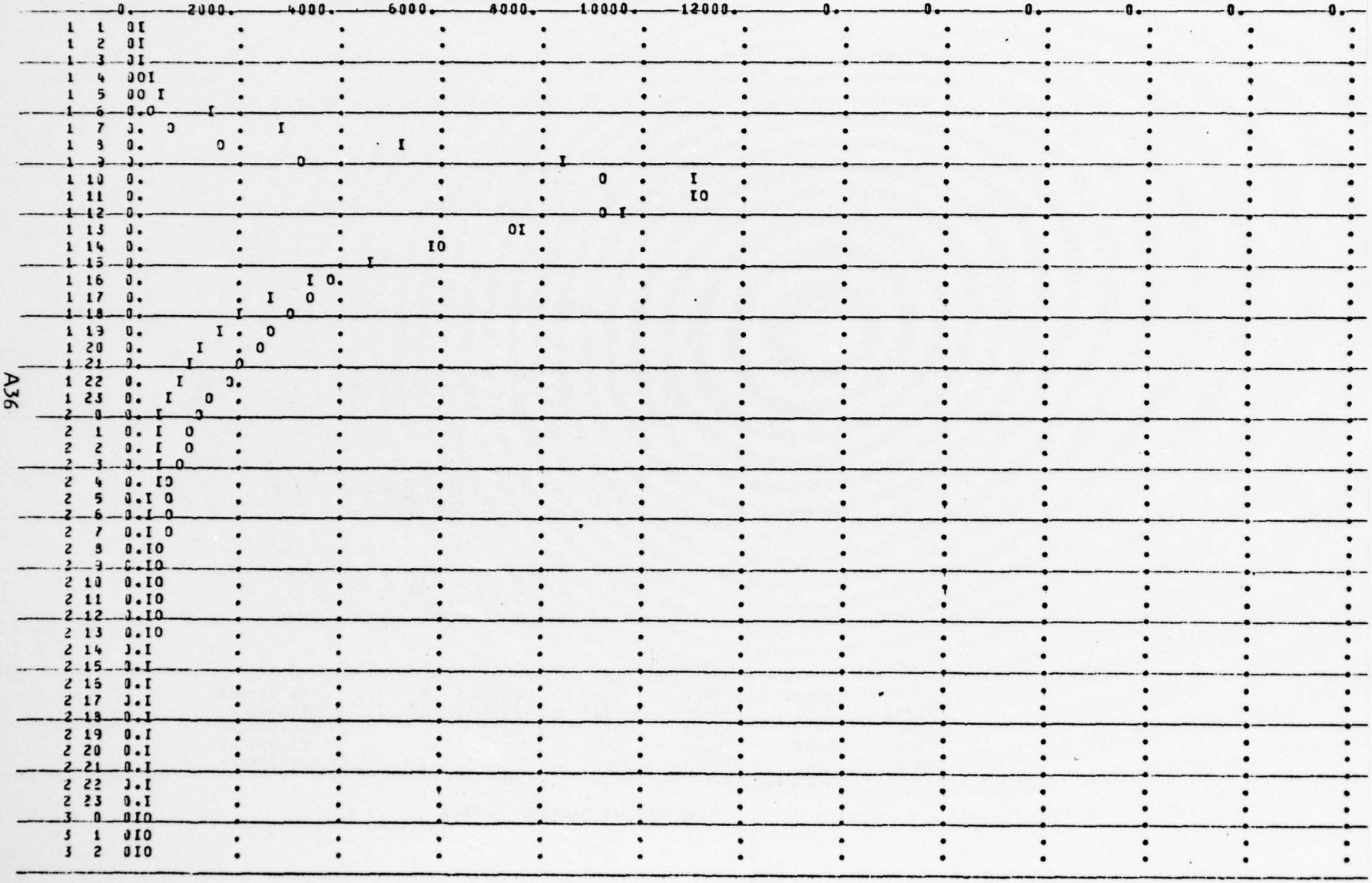
OUTFLOW=	0.	121.	341.	626.	964.	1772.	2728.	3812.	7262.	13112.

TIME			EOP STOR	AVG IN	EOP OUT
1	1	0	0.	0.	0.
1	2	0	0.	3.	0.
1	3	0	2.	27.	3.
1	4	0	12.	122.	13.
1	5	0	48.	468.	51.
1	6	0	148.	1337.	187.
1	7	0	349.	2823.	614.
1	8	0	682.	5126.	1564.
1	9	0	1186.	8495.	3229.
1	10	0	1573.	10932.	9285.
1	11	0	1628.	10930.	11230.
1	12	0	1571.	9519.	9207.
1	13	0	1518.	7644.	7358.
1	14	0	1454.	5897.	5970.
1	15	0	1390.	4505.	4599.
1	16	0	1331.	3455.	3735.
1	17	0	1251.	2625.	3455.
1	18	0	1145.	1984.	3083.
1	19	0	1033.	1542.	2696.
1	20	0	926.	1224.	2344.
1	21	0	825.	960.	2013.
1	22	0	733.	741.	1714.
1	23	0	648.	568.	1462.
2	0	0	574.	453.	1240.
2	1	0	512.	395.	1054.
2	2	0	461.	362.	908.
2	3	0	418.	334.	795.
2	4	0	382.	311.	700.
2	5	0	351.	291.	620.
2	6	0	325.	274.	560.
2	7	0	303.	258.	507.
2	8	0	283.	244.	461.
2	9	0	266.	233.	421.
2	10	0	251.	224.	387.
2	11	0	238.	215.	357.
2	12	0	226.	205.	332.
2	13	0	216.	193.	312.
2	14	0	205.	180.	293.
2	15	0	196.	169.	276.
2	16	0	187.	158.	259.
2	17	0	178.	149.	243.
2	18	0	171.	139.	228.
2	19	0	163.	131.	214.
2	20	0	156.	123.	201.
2	21	0	149.	116.	189.
2	22	0	143.	109.	178.
2	23	0	138.	103.	167.
3	0	0	132.	97.	157.
3	1	0	127.	91.	147.
3	2	0	122.	86.	139.
	SUM				85157.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11230.	7941.	3310.	1703.	85157.
INCHES		4.42	7.37	7.91	7.91
AC-FT		3940.	6568.	7041.	7041.

STATION 4

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)



RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	6234.	5106.	1909.	920.	8.70
ROUTED TO	2	5815.	4631.	1703.	882.	8.70
HYDROGRAPH AT	3	5780.	4734.	1762.	850.	8.00
2 COMBINED	4	11414.	9023.	3445.	1732.	16.70
ROUTED TO	4	11230.	7941.	3310.	1703.	16.70

PREVIOUS INSPECTION REPORTS

Annual Report - Dams

Application No. 9 For year: 1968

Name of Dam ABSALOM DOUGHTY POND Date of Inspection: May

Owner, Name CITY OF ATLANTIC CITY

Address City Hall, Tennessee & Atlantic Aves.
Atlantic City, N.J. 08401

Description of condition of the following:

1. Embankment (Erosion, seepage, etc.) Embankment is in good condition. The no evidence of erosion or seepage on the down streem face. The rip-rap, on the up stre face consists of 12'x12' concrete slabs, some of which have settled due to erosion of em ment below waterline. This condition has been corrected by hydraulically packing sand through opening at the joints of the slabs above the waterline.

2. Spillway (Concrete spalling, timber rotting, leakage, etc.) Spillway is con structed of concrete and is in good condition; there is no spalling concrete.

3. Emergency Spillway (Erosion, growth of sod, riprap, etc.) There is no emergency spillway.

4. Outlet Works (Work ability of valves, gates; Condition of pipe; etc.) The outlet pipes are all working properly. One blow-off valve requires a replacement of its valve stem.

5. Inlet stream (s) (Silt deposition,etc.) There are two (2) inlet streams an both are clear of silt deposits.

6. Outlet stream (Scouring, undercutting of dam, etc.) Condition of stilling basin, if any. Outlet stream has a stilling basin which is in good con tion and there is no evidence of scouring or under-cutting of the dam.

7. General

a. Did flood waters overtop dam during period of report?
If so, at what stage and date thereof. Flood waters overtop the spillway of the dam but not the dam itself. This overtopping is continuous most of the ti

b. Report on any other condition not covered above. None.

c. In your opinion, does existing condition warrant repairs?
If so, where and to what extent. With the exception of replacing valve stem on one of the outlet valves and continuing the packing of sand under the rip-r slabs, the existing conditions do not warrant repair.

d. Submit photographs of the upstream and downstream faces of the embankment, main spillway and emergency spillway noting date taken. The required photographs are herewith attached.
~~Use additional sheets if necessary~~

Inspected by Joseph A Dehnick

Joseph A. Dehnick, P.E.
~~Consulting Engineer~~
N.J. License No. 1844

Date: May 15, 1968

Appendix 9

Report on Dam Inspection

LOWER DOUGHTY POND

DAM NO. 36-1

LOCATION 36.13.2.2.1

On April 20, 1942, in company with Mr. Max Grossman, Superintendent of the Atlantic City Water Department, inspection was made of the repairs which have recently been completed at the spillway of the lower pond of the Atlantic City Water Department on Absecon Creek at Absecon, Atlantic County.

The spillway and wing walls have been repaired by the use of "Gunite" and a very good job has been obtained. There is a small amount of seepage evident on the downstream face of the spillway, which worries Mr. Grossman, but which did not appear serious to the writer.

At the present time forms are in place for additional training walls, which will eliminate pockets behind the spillway wing walls, in which floating material formerly gathered.

A Cochrane indicating orifice meter has been installed in the pipe line leading from this pond to the pumping station, and at the time of inspection delivery was at the rate of 2.0 m.g.d.

The pond level was 2 feet below the crest of the spillway.

The total delivery from the pumping station at the same time was 13.5 m.g.d.

The present condition of the dam and spillway is satisfactory and no action is required.

Trenton, New Jersey
April 22, 1942

John M. Brooks,
Assistant Division Engineer